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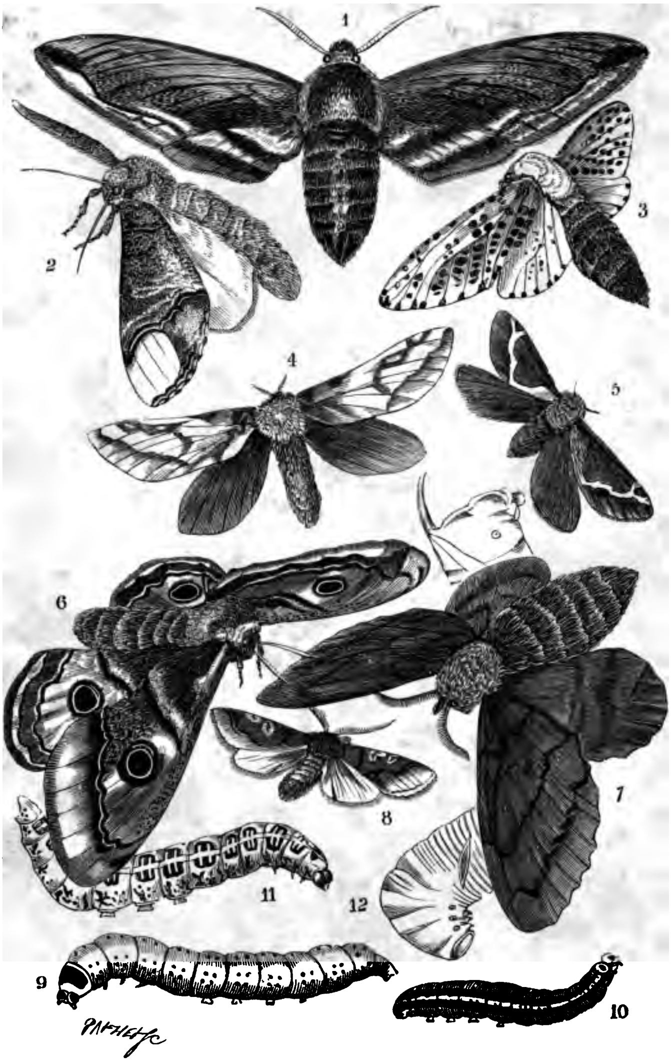
OUR GARDEN FRIENDS AND FOES

PLATE V



1. Sphinx ligustri. 2. Phalera bucephala. 3. Zeuzera æsculi. 4. Hepialus lupulinus.
5. Hepialus humile. 6. Saturnia pavonia-minor. 7. Gastropacha quercifolii.
8. Diloba cærulæocephalus. 9. Larva of Zeuzera æsculi. 10. Larva of Diloba cærulæocephalus.
11. Larva of Phalera bucephala. 12. Larva of Sphinx ligustri.

OUR

GARDEN FRIENDS

AND

FOES.

BY THE

REV. J. G. WOOD, M.A. F.L.S. ETC.

AUTHOR OF

"ILLUSTRATED NATURAL HISTORY," "COMMON OBJECTS OF THE SEA-SHORE,"

ETC. ETC. ETC.

WITH UPWARDS OF 200 ILLUSTRATIONS BY T. W. WOOD, COLEMAN, SMITH,

ETC.

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PREFACE.

THE object of this work is to furnish the reader with a guide to the various beings which can exercise any influence upon our gardens and greenhouses, to enable the cultivator to distinguish between his Friends and his Foes, and to give simple directions for encouraging the one and exterminating the other. The amateur florist will find in this work a list of several hundred beings which are commonly to be seen in gardens, and those who do not even possess a few yards of ground, and are forced to content themselves with in-door floriculture, may derive aid from its pages.

In order to assist the reader in identifying the creatures which are described in the work, figures of all the principal objects have been given. The larval as well as the perfect forms of insects are mostly figured, and are all drawn of their natural dimensions.

I must here discharge a debt of gratitude, by returning thanks to the many friends who have given their

assistance. My acknowledgments are especially due to Mr. F. Smith of the British Museum, for many interesting accounts of the habits of insects, and to Mr. Waterton, the veteran naturalist, for his valuable comments upon the influence of animal life upon vegetation, as exemplified by the system so long and so successfully applied at Walton Hall.

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7. Gastropacha quercifolia.
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OUR GARDEN FRIENDS AND FOES.

CHAPTER I.

The Rodent Tribes and their Influence upon Gardens—The RABBIT—Civilization and Cultivation—Their Effect on the Native Fauna—Varieties of the Rabbit—Its Ravages on Trees—Several Methods of deterring and trapping the Rabbit—The HARE: its Effects on the Garden—The SHORT-TAILED FIELD MOUSE—Its Habits and Ravages in the Garden and Shrubbery—Method of Destroying—The WATER RAT—Localities where it is injurious—The LONG-TAILED FIELD MOUSE—Its Habits—Poisons and the Method of using them—A Caution—The MOLE—Its Habits—An Old Proverb with a New Application—How to get rid of the Mole.

AMONG the Mammalia, the worst enemies to the garden are invariably found to belong to the Rodent tribes. Vegetable-feeders, endowed with a large appetite, and armed with chisel-edged teeth that enable them to cut their way through almost any substance which is not stone or metal, they are most formidable foes to the trees and plants of our gardens.

For the most part, they are also gifted with great powers of overcoming obstacles; and in an inclement season, when the fields are locked up by frost, and hunger reigns among the active rodents, there are few gardens which can be considered safe from their inroads. I say the *active* rodents, because there are some which, like the squirrel and dormouse, remain during the cold months in that strange phase of existence which is known by the name of hibernation, and live upon the stores within and without themselves which they have accumulated during the last months of autumn.

There are few walls which a rat or a mouse cannot surmount, and the rabbits have an astonishing power of discovering a weak point and insinuating themselves through a small aperture. Hares are kept at bay with much greater ease than rats and rabbits; for though, like all other animals, they are rendered desperately bold by the griping pangs of hunger, and will face many a danger in search of food, they cannot climb over a fence nor burrow under it.

But the rabbits, rats, and mice, are such terrible pests to the gardener, that we must devote a few pages to their habits and the best mode of resisting or preventing their depredations. As to the squirrels and dormice, their numbers are so small that the danger which they can work is comparatively unappreciable when compared with the devastations achieved by the hosts of the creatures which we are about to describe.

RABBIT.—*Lepus cuniculus.*

In this book, I do not purpose to give descriptions either of the appearance or general habits of creatures so well and familiarly known as the Rabbit, but merely to speak of them in their relationship to our gardens, to distinguish between the benefits which they confer and the damage which they inflict, and to mention the simplest and most effectual plans for encouragement in the one case, and prohibition or destruction in the other.

We must start with the supposition that every animal has been created for some good and wise purpose, and that, so long as it remains in the place for which it was intended, it is performing its allotted task, in common with all other animated beings, and may be left uninjured and undisturbed in its native home.

The spread of civilization, and the consequent increase of cultivated ground, have greatly limited the space wherein wild animals can be permitted to roam unmolested. Their place knows them no longer; man steps in, takes possession of the land, to which he has a divinely-given right, and before his footsteps the beasts of the field melt away like snow-wreaths before the genial breath of the vernal gales. The land is theirs no longer; they become trespassers if they venture upon those spots where they lately disported in all the freedom of unrestricted possession, and must suffer the penalty of their intrusion. Their place is in the warren, and not in the garden, and to their place they must be restricted.

Although there is but one acknowledged species of British Rabbit, there are at least three varieties of the animal which can be distinguished by a practised eye. Whether these varieties be the result of successive generations indulging in similar habits, or whether they may be merely eccentricities of conduct in certain individuals, is rather doubtful. The fact, however, exists, and is so generally known, that there are different names current among the country folk, illustrative of the peculiar habits contracted by the animals. The Rabbits which always remain in and about the warrens are termed "warreners;" those which leave the warrens, and take up their abode in the open grounds, are termed "parkers;" and those which lead a nomad life, wandering from one part of the country to another, receive the appropriate title of "gipsies." The last-mentioned kind are considered to be the most destructive in gardens, and it is remarkable that they have a kind of vagabond air about them, their fur being ragged and ill-conditioned. In some parts of the country the "gipsy" Rabbits are called by the name of "hedgehogs."

When Rabbits find their way into a well-stocked garden, they work direful mischief in a very few hours. They eat away the young and tender plants; they nibble off the tops and new shoots of shrubs; and, in default of better food, or even in sheer wantonness, they will bite away the bark from the fruit-trees, and leave it lying in flakes upon the ground.

For the former depredations there is no remedy but the death of the intruders, but for the latter there are several remedies. Rabbits detest the smell and taste of tobacco; and a strong dose of tobacco-water—*i. e.* water in which the roughest and coarsest tobacco has been boiled—affords an effectual check to their ravages. But as the tobacco-water would soon be washed away by the first rain, and might not adhere to the tree-trunk in sufficient quantity to produce the desired effect, it is better to mix it with substances that render it thick and adhesive. Clay, cowdung, and similar substances are useful for this purpose, and some persons are in the habit of adding a little glue and lime.

The mixture should be carefully stirred until it is about the thickness of paper-hangers' paste, and be applied copiously to the bark, care being taken to work it well into the crevices. A belt of at least three feet in depth should be applied; and if the season should not be very rainy, a single application will usually be sufficient. In wet weather, however, it must be renewed twice, thrice, or still more often if it should be found to wear away.

Gas-tar is also found to be nearly as obnoxious as the tobacco-water to Rabbits, but it has the disadvantage of possessing a very noisome and far-reaching odour, and of adhering to the dress or hands of those who inadvertently come in contact with it. Nothing will remove it from the hands but the application of grease; and it is by no means agreeable to walk about for a quarter of an hour with the fingers covered with an oleaginous mixture of butter and gas-tar.

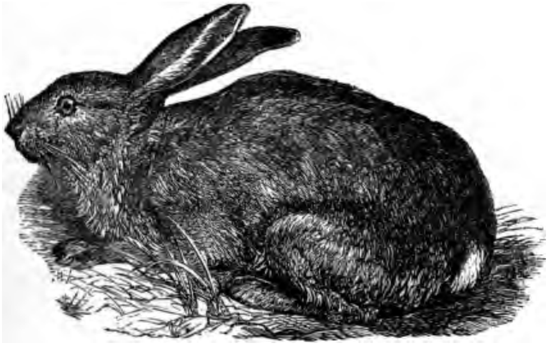
Should the Rabbits be very abundant, the best method of getting rid of them is to block up all their runs except one, which may be left open, or even widened, so as to give the quadrupedal robbers an easy entrance. The Rabbits will be sure to pass through the open aperture, instead of giving themselves the trouble to remove the obstacles that have been placed in their ordinary defiles.

A tolerably deep pit should then be sunk in their path, considerably wider at bottom than at the top, and being carefully finished on the sides so as to prevent the earth from falling in. Have ready a short plank or board balanced over a log of wood, and running on a couple of pins so that it may not fall off, and place this across the path, so that the log is made nearly level with the soil, and the lighter end of the plank projects over the pit. As the Rabbits come into the garden they will pass along the plank, and be successively tilted into the pit, the plank resuming its former position by its own weight. In all such traps it is better to lay down the plank a day or two before the pit is dug, so as to accustom the Rabbits to walk upon it without suffering any inconvenience.

The number that may be caught in a single day is extraordinary; and it is by no means a cruel plan, as the Rabbits are too agile to suffer any damage by the fall. There are many other traps, such as springes, nooses, rat-traps, box-traps, &c.; but in such cases the animal often suffers terrible pain before it dies, being caught by a limb instead of a mortal part. I have often seen the "vermin-traps" with the severed leg of a Rabbit between their iron jaws, the miserable creature having literally torn off the limb in its efforts to escape.

Moreover, the garden-owner might perchance catch and kill one of those fortunate animals which are so especially under the protection of the laws, and so render himself liable to the payment of a penalty under the operation of the game laws. But even if a hare or two should happen to fall into the pit-trap, they can be taken out again and restored to liberty, without having suffered any inconvenience except a few hours' imprisonment.

The aggrieved garden-owner may obtain some satisfaction from the fact that the flesh of the captive robbers is eatable, and that their skins will fetch a moderate price from the agents of the manufacturer, who makes them into "beaver" hats. The fur of the warren rabbit is the most valuable; that of the hedgehog, or gipsy rabbit, is quite useless; and that of the "sweetheart," or domesticated rabbit, is held in very low estimation.



HARE.—*Lepus timidus.*

Although quite as mischievous an animal as the rabbit, as bold, as voracious, and of much larger dimensions, the Hare is comparatively so limited in its numbers, that it can scarcely be reckoned among the more obnoxious of the Garden Foes. It is very fond of delicate green herbage, and, unlike the rabbit, which nibbles a piece here and a piece there, it has a habit of eating its way systematically through a crop, leaving a kind of lane to mark its course. A similar lane is sometimes eaten through long grass by sheep which are sick with the foot-rot; and I have seen a wonderfully long passage cut quite cleanly out of the grass by a sheep that was unable to put its fore feet on the ground and could only shuffle along on its knees.

The Hare is a terrible foe to trees, which it strips of their bark as has already been related of the rabbit. It can, however, be repelled by the mixture of gas-tar or tobacco-water. It has also an unpleasant habit of rearing itself on its hind legs, and eating off the topmost shoots of very young trees. This delinquency, however, rather affects the nursery than the garden.

SHORT-TAILED FIELD MOUSE.—*Arvicola arvalis.*

Among the creatures which are popularly known by the name of Rats and Mice, two species are especially destructive in our gardens, namely, the Short and the Long-tailed Field Mouse.

The Short-tailed Field Mouse does not, however, rightly belong to the mice, being allied to the beavers, and forming, together with the water rat, or water vole (*Arvicola amphibius*), and the bank vole, or bank campagnol (*Arvicola glareolus*), the only relics of that group of animals.

Although seldom seen, on account of its shy and retiring habits, and the peculiar reddish brown of its coat, which enables it to glide unsuspected at the very feet of the searcher, this creature is very plentiful in our country—far too plentiful, indeed, to please the woodman, the farmer, or the gardener.

To the last-mentioned personage it is especially obnoxious, as it can burrow with wonderful rapidity, and eats the roots which are apparently in safety. In some seasons these mice will make terrible havoc among the bulbous roots that have been planted with infinite care; and when the expectant owner looks out in the spring for the delicate green shoots to thrust their pointed heads into the upper air, their places are vacant, for the mice have eaten them.

I am perfectly aware that, in many cases, the mice have to bear the blame which really belongs to the gardener. Sometimes the roots have been carelessly inserted, without the proper kind of soil laid round them, or sometimes a dishonest gardener pockets a large percentage of the bulbs, places his marking sticks where the bulbs ought to be, but are not, and then, when summoned by the owner of the garden, and called upon to explain the cause of the disappearance, he lays the fault on "them mice," or perhaps on the crows, if he thinks that his employer is not much of an ornithologist.

Still, these mice are terribly mischievous little beings, and are not easily caught or detected in their depredations. They have very accommodating palates, and will eat almost any growing vegetable, particularly if the owner sets a special value upon it. Sometimes the mouse eats grain, getting into the ricks and working terrible destruction therein during the winter. It cannot be ejected from the rick like the rat, and therefore is quite as mischievous, though not nearly so large.

Rats are thirsty beings, and if a stack be built on well-made staddles, and a colony of rats should contrive to get into it by means of a stick or a tool left carelessly leaning against it, and acting as a bridge over which the rats can run, even under these circumstances they can be dislodged by drought, either by waiting for fine weather, or by placing a rick-cloth over the stack. The rats would speedily die of thirst in such a locality, and are obliged to jump to the ground in search of water, when of course they are unable to make good their admission afresh.

Mice, however, cannot be dislodged in this simple manner, as they find a sufficient supply of water in the dew that collects upon the thatch, and may be seen in the early morning, poking their little red heads out of their holes, and licking up the dewdrops that hang glittering upon the straws. When this mouse gets into barns, it also does very great mischief. Yet it is seldom found in very dry localities, those being mostly occupied by its long-tailed relative, of whom we shall presently speak, preferring damp and low-lying situations, especially those which are near a series of water meadows.

Among other roots to which it is partial may be named the carrot, and it has an unpleasant way of eating out the greater portion of the interior, leaving the outer skin or rind almost entire. It also feeds upon the bark of trees, and does not content itself with merely nibbling round the base, as is done by the hare and rabbit, but climbs up the trunk, runs out on the branches, and there feeds at its leisure. It damages the trees below ground as much as above, making no account of the roots when they happen to intersect the course of its burrows, but eating its way through them, and cutting them across with its sharp teeth.

Hundreds of young trees have been killed in a single forest by these little marauders, and even after they have attained the height of five or six feet, their roots have been cut across by the chisel-edged teeth of the Field Vole, just below the surface of the ground, so that no intimation of the foe was given until his destructive work had been completed.

Failing corn in the ear, corn in the sack, corn in the yard, bulbs, seeds, roots, and bark of all descriptions; the Field Voles become cannibals, and feed upon each other.

Its ordinary habitation is in a burrow, sometimes constructed by itself, but frequently the deserted domicile of a rat or mole, of which the ruddy usurper takes possession. Any one can distinguish a Field Vole at first sight, by means of the chestnut-red upper part of the body, the blunt muzzle, and the very short tail, which is barely one quarter of the length of the body. It is, moreover, very scantily covered with hair, and blunt at the tip, and presents a great contrast to the long, graceful, and pointed tail of the domestic mouse. The ears are very small, barely showing their tips above the fur, much as is the case with the well-known water vole.

The total length of an ordinary specimen is rather more than five inches, the tail being little more than one inch in length. Below it is ashen grey, and the feet and tail are brown without much red in them.

It is a very prolific little creature, the number of young at a birth varying from four to seven.

When this little pest has made its way into a garden, its extirpation is a matter of some difficulty. It has no particular runs, and cannot be easily caught in traps. It does not seem to care about eating poison as long as it can bark trees and nibble roots and bulbs to pieces. Cats may sometimes catch the Field Vole by night, but a nightly prowling cat is generally intent either upon poaching or love-making, and in neither case would it trouble itself about such insignificant objects. If a Field Vole ventures out by day, and a kestrel happens to be near, the mouse is a dead quadruped, and after dark the owls will give good accounts of any stragglers.

Still, their numbers are at some times and in some places so formidable that it is necessary to try some plan of diminishing their hosts. The only method that seems to have met with real success is the pitfall, being a simple hole in the ground much larger at the bottom than at the top, and having smooth sides. Many thousands of Field Voles have been taken in these simple traps; and, according to Mr. Bell, the farmers of Liege have been very successful with pitfalls constructed on the same principle, but of very small size, being only a foot in depth, and four inches wide at the mouth.

There is no necessity for baiting these primitive traps, as was at first supposed, as the mice tumble into them quite as freely without bait as with it.

The WATER VOLE, or WATER RAT, as it is often called, is scarcely to be reckoned among the foes of the garden, though it certainly may not take rank among the friends. There are but few gardens which are washed by streams, but in those cases the Water Vole sometimes becomes a real foe to the garden.

It is now well known that this animal is a vegetable-feeder, except under the pressure of absolute starvation, and that the fish and other aquatic creatures which are seen half devoured on the banks of streams and ponds have been killed by the common rat, which has taken up a summer residence by the water side. Driven by want, it will sometimes enter gardens and other cultivated grounds, and feed upon the growing vegetables. It possesses a very discriminating palate, and has been observed to enter a garden, make its way to the place where some French beans were growing, bite off the green pods, and carry them away to its burrow.

WATER VOLE.—*Arvicola amphibius.*

The harm that the creature does is so trifling, that it need not be persecuted or killed; but, as it does occasionally rob our gardens, it must find a place among the Garden Foes.

The **Long-tailed Field Mouse** may be readily distinguished from the field vole by the much longer tail, the sharper nose, and the larger ears. Indeed, in many points, this creature is very similar to the common domestic mouse.

This little animal prefers dry ground, and is especially injurious to the kitchen garden, not only devouring the roots and seeds, but carrying them away, and laying them up in its storehouses.

These treasuries are always underground, sometimes in excavations made by actual labour, but more frequently in hollows under the gnarled roots of old trees, or in old mole burrows. Here is collected a strange medley of provisions, such as chestnuts, acorns, nuts, and seeds of various kinds, the creature being strictly a vegetarian, except when threatened with absolute starvation, in which case, like the field vole, it will feed upon its own kind.

Though timid, and but rarely allowing itself to be seen, and running away from impending danger, it can turn fiercely upon its pursuer when it sees no chance of escape, and will fight valiantly for its life. I have had my finger bitten to the bone by one of these little quadrupeds, that had contrived to fall into a tub half full of grain, and could not make its escape. Thinking no harm of the tiny creature, I put my hand into the tub, chased the mouse from one side to another until it was wearied, and I was able to seize it by the tail, when it suddenly twisted itself round, seized the tip of my forefinger in its mouth, and drove its chisels of teeth deeply into the flesh. I had no idea

LONG-TAILED FIELD MOUSE.—*Mus sylvaticus.*

that so small a being could inflict so severe a wound, for the blood literally pattered on the ground, and it was some little time before I could staunch the bleeding.

This little mouse is found throughout the greater part of Europe, and is universally considered to be one of the chief pests of the agriculturist.

Various methods for its destruction have been tried, among which the pitfall and poison are the two which appear to have been most successful. Several kinds of poison have been tried, and those that are most effectual in proportion to their cost are very easily made. One recipe is as follows: White hellebore root, powdered, barley meal, honey, and milk, all mixed well together, and strewn over the places where the corn has been sown. The mice come to dig for the corn, but finding this sweet compound lying ready for them they eat it, and speedily die.

Another recipe is: One ounce of nux vomica very finely ground, one pound of wheaten flour, three ounces of treacle to make the mixture sweet, and a few drops of oil of carraways to make it enticing. Some experienced persons, however, omit the essential oil, asserting that though it will attract rats, it will repel mice.

Perhaps the best poisons are those which have phosphorus for their bases. There are several recipes for the manufacture of these deadly compounds, of which the following appears to be as simple and effectual as any:—

Take one pound of lard, place it in a large wide-necked bottle or jar, and plunge it into a vessel filled with water heated to about 150 degrees Fahr. Wait until it is thoroughly melted, and then pour in one pint of proof spirit and one ounce of phosphorus. Cork the bottle firmly, take it out of the water, and shake it until the whole mass becomes of a milky-white colour, and quite fluid, without any knot or streaks in it. If the ingredients should not mix properly, place the bottle in the hot water again, and repeat the process until the operation is satisfactorily completed. Lay the bottle aside in a cool place, and the phosphorated lard will form itself into a hard white mass, while the spirit lies clear upon the surface, and can be poured off for use upon another occasion.

When you wish to use this poison, take out a portion and mix it with flour, just as a cook makes her pie-crust, adding at the same time some sugar and a few drops of any essential oil, such as anise or rhodium, which may serve to attract the mice. If you can find their burrows, put small lumps of the poisoned paste into them; but if not, strew it carefully over the place where the seeds are buried. Of course, this and other poisons should never be used in houses, or where there is any likelihood of children or domesticated animals getting at it.

Some persons do not use lard or dripping, but substitute for it starch, the phosphorus being added just when the starch is formed into a jelly with hot water, and then stirring it up with a wooden spoon or flat stick. It must be remembered that phosphorus is a dangerous substance to handle, and that it should never be touched with the fingers, nor cut in the open air. It should be kept in water, and cut under water. The safest plan, however, for one who is not accustomed to handle phosphorus is to get the druggist to weigh it.

If properly used, this poison is preferable to all others, because its pecular smell will distinguish it in the daytime, and its luminosity will indicate it at night, so that there is not so much fear that it should be eaten by mistake, as is too frequently the case with those made of arsenic or strychnine. The "vermin powders" sold in the shops are mostly composed of the latter substance.

Whatever poison may be employed, the gardener should take care that any portion which the mice do not eat in the night-time shall be removed at earliest dawn; otherwise the birds will be sure to come and eat it, and the mischief of such a proceeding will be shown in a subsequent page.

Another plan has been recommended as having met with partial success; and, as it dispenses with poisonous substances of any kind, is useful to those who only wish to preserve their own crops from damage without making any attack upon the mice. Wherever the gardener has set peas, beans, bulbs, or any plant which the mice eat, the ground should be covered with a layer of fine coal ashes, about one inch in thickness. This is said to be obnoxious to the mice, who dislike the task of digging in the ashes; and at the same time the plants are protected by the warm covering until they have obtained considerable strength.

I purposely omit the two British rats, namely, the COMMON or NORWEGIAN RAT (*Mus decumanus*) and the BLACK RAT (*Mus rattus*), because they are more properly foes of the farm-yard and corn-field than of the garden, and because they can be detected and slain in the same manner as is employed for the mice.

MOLE.—*Talpa Europæa.*

PASS we now from the rodent animals which feed upon the crops, to the carnivorous animals which do no direct injury to the vegetables, but are nevertheless hurtful in a garden.

The common MOLE is seldom seen above ground, although there are times when, urged by love or anger—these two passions seeming to be almost inseparable in the Mole—it leaves its burrow, and pursues its intended mate or fights with its hated rival in the light of day.

One of my friends saw a pair of Moles thus fighting in a most desperate manner. They went tumbling over each other among the dead leaves and dried twigs of the underwood, and were so absorbed in their fray, that they allowed him to seize one of them before they attempted to escape. He flung the captive into the air at once, so as to prevent it from biting him, caught it as it fell, wrapped it up in his handkerchief, and carried it home in safety.

There is no doubt but that the Mole is a most useful animal to the agriculturist, as long as it keeps itself to the fields, and does not increase too rapidly in numbers. But if it gets into a garden, especially if that garden be surrounded with walls, it drives the owner almost distracted with the mischief it works. There is no getting rid of the creature, which doubtlessly would be quite as pleased to escape as the gardener to eject it. It burrows under the flower-beds—emerges, perhaps, on the lawn, throwing up a heap of mould on the velvet grass—drives its tunnels through the best soil—or sometimes cuts up the ground into trenches, with here and there a little heap of mould, just as if a plough had been drawn over it. A bull is a very useful animal in the field, but it is proverbially mischievous in a china-shop; and in a similar fashion, the Mole, which is so beneficial to the fields, is by no means a proper inhabitant of the garden.

One would naturally suppose that the Mole might burrow under the wall, and so escape; but, by some fatality, it seldom succeeds in doing so; and even in that case, the burrow remains, and acts as a passage for the creature to make its entrance on another occasion. If there should be a professional mole-catcher in the neighbourhood, he should be summoned to the spot, and set on the track; if not, the ingenuity of the gardener will be taxed to rid himself of the intruder. I think that nothing is more calculated to kill one of these intruding Moles than a small gin set in their run; and if two or three can be distributed in different parts of the garden, so much the better. Moreover, the Mole is always savagely hungry, and a bait of a dead bird or mouse will in all likelihood serve to entice the animal to its destruction.

Though the Mole is a truly carnivorous animal, it has been known to eat certain vegetable substances, the remains of various roots having been found in its stomach. Mr. Bell, however, has some excellent remarks upon this subject, which set its alleged vegetarianism in a true light. "It is true that vegetable matters are occasionally found in the stomach; but this no more proves them to be vegetable feeders than the accidental reception into the stomach of some particles of sawdust by a captive lion, who has had his food thrown to him on a floor covered by this substance, would indicate that the lion is a feeder on sawdust. The cases are exactly parallel. The Moles gnaw the roots of plants for the purpose of extracting from them such larvæ and worms as feed upon them; they likewise seize upon earthworms which are entwined amongst the masses of fibrous roots and earth which constitute the superficial layers of grass-lands; and, in each case, portions of the roots, and of the soil itself, would be swallowed with its actual food."

It is quite possible, however, that the Mole may occasionally eat certain vegetable substances, just as other carnivora, such as dogs and cats, are accustomed to eat grass when their instinct teaches them that they need some of Nature's simple medicines.

HEDGEHOG.—*Erinaceus Europæus.*

CHAPTER II.

Some of our Garden Friends—The **Hedgehog**—Its Food and General Habits—Its Use to a Garden—A mooted Question—Its docile Nature—The **Shrew**—Its Food and Structure of its Teeth—The **Weasel** and the **Stoat**—Their good and bad Qualities compared—Their Use to the Garden—The **Bats**—Their Habits and Services.

I believe that we have now noticed all the British Mammalia that can be considered as foes to our gardens; and our more agreeable duty is now to mention those which are to be reckoned among our friends.

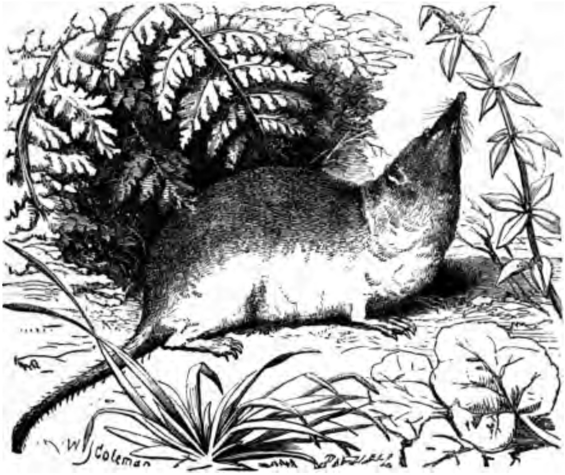
The first of our Garden Friends is the **Hedgehog**, sometimes called the **Urchin**, **Hedge-Pig**, or **Furze-Pig**. Though reckoned by some writers and most farmers among our garden foes, the Hedgehog has a right to take a higher rank, and to be placed among the friends of man. It is almost wholly carnivorous in its feeding; and the many stories that are told of its carrying away apples and eggs on its spines, and draining cows of their milk, are either mere traditions, handed down from one generation to another, or are the result of imperfect observation.

The chief food of the Hedgehog consists of insects, beetles being its special favourites, because they are easily caught and contain plenty of nourishment. It will also eat earthworms, snails, and slugs, and has been known to prey upon larger animals, the field-mouse being reckoned among its victims. During the winter, it hybernates, betaking itself to the hedgerows, and there making up a soft, warm bed of leaves, in which it lies completely ensconced, till the warm breath of spring rouses it to life, together with the noxious creatures on which it feeds.

It certainly is known to eat some vegetable substances, and was detected by that accurate observer, Mr. White, of Selborne, in the act of devouring the plantain, by grubbing under the plant with the long snout, and eating off the root, leaving the stem untouched. It is just possible, however, that there may have been some grubs in the root which caused the Hedgehog to act in this manner, and, at all events, the plaintain is not a herb that we care to see in our gardens, and, for destroying it, the Hedgehog ought rather to be considered a friend than a foe.

It is easily tamed; and though, when first handled, it rolls itself into a ball, horrent with bristling spears, it soon learns to distinguish its friends, and allows itself to be touched without attempting to defend itself by this curious process.

Near to my house lives a very little boy, who made friends with a Hedgehog after the usual childish fashion. Every one knows how a cat will allow itself to be lugged about by children, hung over their clasped hands, carried about like a baby, or even tucked carelessly under their arms. But few persons would have imagined that a Hedgehog would have permitted such liberties to be taken with it. Yet, in a very short time, the little boy was accustomed to treat the Hedgehog as if it had been a puppy or a nursery kitten, carrying it about the garden, putting it down and picking it up again, without suffering in the least from its prickly armour.



SHREW.—*Corsira vulgaris*, or *Sorex araneus*.

In the list of our Garden Friends we may reckon the common Shrew, a little creature that has been evilly spoken of for many years, and is likely to retain its bad name so long as prejudices endure and men will not listen to reason. In reality, it does no harm to any living being except to the insects on which it feeds; and if farmers only knew their friends from their enemies, they would cherish and protect the Shrew instead of fearing and killing it.

As it is popularly called the Shrew Mouse, many persons imagine that it belongs to the rodent tribes; but a glimpse at its mouth will show that, in common with the hedgehog and mole, it is one of the insect eaters. I well remember finding a dead Shrew when I was a very little boy, and being sadly puzzled about its teeth. I had read about the teeth of rodent animals; I knew that mice were rodents; the creature looked like a mouse, and every one told me that it *was* a mouse; yet I could not make out the teeth. As might be expected, I laid the fault on my own incompetence; and it was not until long afterwards that I found out the clue to this difficulty.

The Shrew ought always to be protected. It has many enemies, and, moreover, is liable to a kind of epidemic in the later months of the year, which kills it in great numbers, hundreds being found lying dead without any apparent cause for their death.

Several kinds of Shrews are found in England, all of which can be at once known by their very long and slender snouts and their squared tails. The present species is reddish brown above, and paler on the under surface; the feet are all formed for running; and the tail is not fringed beneath. The Water Shrews are distinguished by their fringed feet and tail, the stiff, short hairy edges acting as oars and enabling the creatures to propel and direct their course through the water.

As gardeners, we ought to cherish the whole of the Weasel tribe—polecats, ferrets, martens, stoats, and weasels. Whether as farmers or as poultry-keepers we should do so, is a still mooted question, and one with which in our present capacity we have nothing to do.

The two commonest species of this tribe are the WEASEL and the STOAT, but as they both have very similar habits, render us similar services, and resemble each other closely in appearance, we have only given the former as the type of its tribe. There is no doubt that farmers and poultry-keepers have some grounds of complaint against it, inasmuch as it certainly does kill the young chickens; and game preservers have perhaps even more reason to rank it among their foes, as it can and sometimes does commit great havoc among the young pheasants and partridges, though it does not equal its larger relation, the Stoat, in its depredations.

But the Weasel is such a determined enemy to mice, and destroys such numbers of the field-mice, that it has a right to our protection. In our gardens it certainly is very beneficial to us, and in that character ought to be encouraged. Not only does it follow the mice through their burrows in the ground, or trace all their meandering tunnels through the corn-rick, but it is also capable of hunting its prey by scent, and is able to pursue the mouse as surely as a good hound follows a fox. In this pursuit it displays wonderful intelligence, and if it loses the scent runs over the ground like a well-taught dog until it hits off the track, and then runs gaily forward, hunting down, by dint of perseverance, animals far larger and swifter than itself.

WEASEL.—*Mustela vulgaris.*

The reader must bear in mind that in this work I do not pretend to give a full account of the various creatures which are described, as in that case our space would be exhausted before we had half completed our task. I therefore restrict myself to those habits of the animals which relate directly or indirectly to the garden.

Some persons confuse together the Stoat and the Weasel; they may, however, be easily distinguished by the much smaller size of the latter animal, its redder back, white belly, and uniformly red tail, that of the Stoat being always black at the tip and somewhat bushy. On account of its lithe, snake-like form, it can follow the mice in places where a Stoat could not pass, its short legs propelling the body while they scarcely project beyond the line of the belly. Generally, the bite of the Weasel is instantaneously fatal, the delicate, needle-like teeth being driven into the base of the brain. In case, however, of a failure in this respect, the Weasel clings tightly to its prey, throwing itself upon it, and preventing it from escaping.

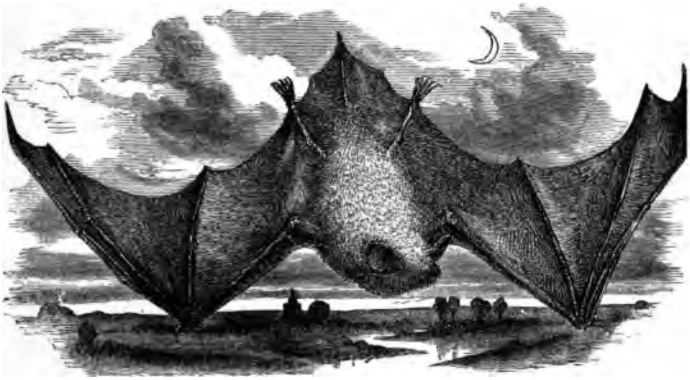
Mr. Waterton, who has given much time and attention to the Weasel, speaks also of the havoc which it makes among rats as well as mice:—"That man only who has seen a Weasel go into a corn-stack can form a just idea of the horror which its approach causes to the Hanoverians collected there for safety and plunder. The whole stack is in commotion, while these destroyers of corn seem put to the last shift, if you may judge by the extraordinary kind of whining which goes on amongst them, and by the attempts which they make to bolt from the invaded premises.

"When a warm and sunny morning invites you to sit down in some secluded spot, you can scarcely fail to have an interesting sight of the Weasel. While all is still around you, it may be seen coming out of a hole in the ground, with its head particularly erect at the time: and it starts and stops at intervals, as though it were afraid to advance. On these occasions it is often seen with a mouse in its mouth, or with a rat, which it has surprised and brought out of its hiding-place in the hedge-bottom. It will catch beetles with surprising agility, and as wrens, robins, and hedge-sparrows hop from spray to spray on the leafy bush, just a few inches from the ground, it seizes them there, but does not begin to eat them till it has conveyed them to its place of retreat."

After narrating the general history of the Weasel as seen by himself, and giving it full credit for the game and poultry which it destroys, he saw a weasel chase and kill a full-grown rabbit and kill it by a bite behind the ear, and he makes the following observations, with which I conclude our notice of the Weasel:—

"But, of all people in the land, gardeners have most reason to protect the Weasel. They have not one single word of complaint against it—not even for disturbing the soil of the flower-beds. Having no game to encourage, nor fowls to fatten, they may safely say to it, 'Come hither, little benefactor, and take up thy abode amongst us. We will give shelter to thy young ones and protection to thyself, and we shall be always glad to see thee.' And fortunate, indeed, are those horticultural inclosures that can boast the presence of a Weasel; for neither mouse nor rat nor mole can carry on their projects with impunity whilst the Weasel stands sentinel over the garden.

"Ordinary and of little cost are the apartments required for it. A cartload of rough stones, or of damaged bricks, heaped up in some sequested corner, free from dogs, will be all that it wants for a safe retreat and a pleasant dwelling."



THE NOCTULE.—*Noctulinia altivolans.*

All the British **BATS** may be reckoned among the friends of our gardens, inasmuch as they are strictly insectivorous beings, feeding during the night and earliest dawn, and snapping up almost every winged insect that comes across their path. Even the cockchaffer, that terrible pest of the garden, is captured and eaten by these animals; the Great Bat, or Noctule, having been observed to eat those insects, even in captivity. Many moths also are eaten by the Bats; and as the larvæ of the moth tribe are, as a rule, injurious to vegetation, it may be imagined that the Bat renders us no slight service.

Like the hedgehog, it is providentially endowed with a capability of hybernation during the winter, while no insects are seen on the wing, as otherwise it would inevitably perish with cold and hunger. When, however, the warm breath of spring causes the first insects to burst from their shelly prisons and to assume their wings, the Bat also awakes from its wintry torpor, and even in broad daylight may be seen to pass over ponds and lakes with rapid wing, snapping up the gnats that are dancing about in the unaccustomed sunbeams. At first, however, it makes but a brief flight, returning to its domicile after a short time, and relapsing into the torpor from which it had awakened. Soon, however, it throws off its heavy sleep, and darts about on swift but devious wing. When in full possession of its faculties, it performs the same office for the air as is achieved by the hedgehog for the ground, and deserves our protection as fully.

CHAPTER III.

BIRDS.

BIRDS—The Hawk Tribe—The KESTREL—Its Flight—Its Rapacity—Fondness of Human Society—Its peculiar Flight—Its Nest—The Owl Tribe—The BROWN OWL—Its Habits and Mode of Nesting—The WHITE or BARN OWL—How to encourage it—Its Food and Effect upon the Garden—The GOATSUCKER and the Benefit which it confers on Man—Its various Names and their comparative Value—The Swallow Tribe—The HOUSE MARTIN—Its Habits and Mode of Feeding—Capriciousness of its Disposition—Its Nest and Young—The WREN—Its Habits and Value to the Garden—The THRUSH and BLACKBIRD—Their Depredations compared with their Services—The Stone of Sacrifice—The ROOK—The great Controversy—The Scales of Justice—The Benefit of the Doubt—The CROW—Its Character and its Uses—The STARLING—Its Services and their Wages—The Starling Tower—How to encourage the Bird—The SPARROW—The "Little Bird" Controversy, *pro* and *con*—The GOLDFINCH and CHAFFINCH—Their Friends and their Enemies—The BULLFINCH and its Habits—The WOODPECKER—Its Food and Habits—The WOOD-PIGEON.

I CANNOT bring myself to believe that any bird ought to be ranked as a foe to our gardens, and think that, at the worst, such birds as the bullfinch or the wood-pigeon may be placed among the neutrals. In treating of the birds, therefore, I shall only mention a few species, taking them as types of larger groups, and proceeding in as systematic an arrangement as is possible.

As a type of the hawk tribe, I have selected the KESTREL, because it is at the same time one of the most familiar of the British hawks, and one of our greatest though least obtrusive benefactors.

Just as the bat and the hedgehog rival each other in clearing the air and earth of noxious insects, so do the weasel and the Kestrel vie with each other in their pursuit of mice, the one hunting them upon the ground and the other sweeping down upon them from the air.

The Kestrel, or Windhover as it is often called, may be readily distinguished from its relatives, such as the sparrow-hawk and the merlin, by the peculiar character of its flight. It does not flash along like the former bird, nor skim along like the latter, but flies quietly for a little distance, and then hovers in the same spot, just as a kite remains fixed by the opposing influences of

KESTREL.—*Tinnunculus alaudarius.*

the string and the wind. By the shivering movement of the wings and the force of gravitation, the place of the string is supplied, while the breeze against which the bird is fluttering discharges its own office.

The food of the Kestrel consists partly of the larger insects, especially the fat-bodied moths and the beetles, and partly—I may say principally—of field-mice. It is to look out for these that the bird poises itself in so strange a manner.

Gifted, as are all the predaceous birds, with an eye that can be changed at will from a microscope to a telescope, it is equally ready to drop down upon some unhappy field-mouse that is creeping along and flatters itself that it is unseen, or to make a sudden dash at a passing insect, seize it with a foot, and transfer the prey to its mouth without taking the trouble to alight. Sometimes it will settle on the ground and devour grubs and caterpillars, or even catch the earthworms and pull them out of their holes.

It is a remarkable fact, that the Kestrel, like the owl, prefers the habitations of man to the open country; and there is scarcely a village, or even a farm, that is not attended by its Kestrels. Pretty birds they are, with their spirited little heads and glancing eyes, the elegant form, the ruddy fawn, dotted with black, of the back, and the pale streaked chest and under surface.

It builds its nests—I should rather say, it lays its eggs—on the top of some tall tree, taking possession of the deserted tenement of the common crow. It never seems to construct a nest for itself, but only squats, as it were, upon alien property.

Mr. Waterton tried the experiment of turning a pair of crows out of their nest in hopes that a Kestrel would take possession, and found that the vacant premises were occupied in less than a week by a pair of these birds. In one year there were twenty-four nests of the Kestrels in the park belonging to Walton Hall, so that if four young be allowed to each nest (which is the usual average, the fifth egg being often addled), one hundred and forty-four of these pretty hawks were at one time flying about the demesne.

BROWN OWL.—*Surnium aluco*

By day the kestrel gives its aid towards thinning off the overflowing numbers of the field-mice, and the Owls perform a similar service by night.

The time has nearly passed away when the few species of Owl which still linger in our island were the objects of universal dread and hatred. I suppose that the only reasons for this widely-spread feeling were, that the Owls have large eyes, that they fly by night, and frighten silly people by their hootings, snappings, and hissings. Even the little day-flying birds partake of the same feeling; and if you wish to have a complete Dutch concert of feathered songsters, you need only take an Owl—any species will do—put it in a cage, hang the cage in the branches of a tree, and await the result.

In a very few minutes some inquisitive sparrow happens to perceive the cage and goes to see what the strange object may be. On catching sight of the big round head and blinking eyes of the Owl, he sets up a screech loud enough to make him hoarse for a week.

Every bird within hearing dashes off to see what can be the matter, for the rough, grating cry of alarm is understood by all the feathered nations, however different their language may be. In five or ten minutes there is an astounding uproar. The birds are all horribly afraid of the Owl as it sits winking in a puzzled manner on its perch. But they are also sensible of a kind of incongruity attending an Owl in daylight, and cannot resist the temptation of pressing round the cage and scolding the poor bewildered bird at the tops of their voices.

If, however, the Owl should happen to snap his beak, or to make a quick movement, there is a sudden dispersion of his persecutors, who dart off in every direction with cries of terror. Thus have I seen a crowd of impertinent street boys beleaguering an arcade or church beadle, the big cocked hat and gold-banded gown being to the boys, what the round head and staring eyes of the Owl are to the little birds. Thus, when the beadle makes a rush at his tormentors, do they all scatter themselves in fear of the uplifted cane, and in the like manner, alas! do they reassemble and hover about him, taking care to keep themselves just outside the boundaries which limit his dominions and of which they are aware as well as himself.

There is hardly any little bird that makes more noise than the starling on seeing the Owl, certainly no bird that runs away so fast or returns so readily.

All the British Owls feed chiefly on mice, although they occasionally vary their diet with a sparrow or some such bird; and at times seems to prefer the larger insects, especially the beetles, to any other kind of food. The different species of Owl take up different residences. The Brown Owl, for example, or Tawny Owl as it is sometimes called, prefers to roost in hollow trees, and is so much attached to this particular residence, that unless it can find a suitable residence it refuses to breed. Any one, however, who possesses a hollow tree in a tolerably quiet locality, can mostly attract a pair of Brown Owls by scooping out the dead wood, fixing a convenient perch, and otherwise attending to the wants of the anticipated guests.

Mr. Waterton's plan of encouraging this species of Owl is excellent. He begins by remarking that the Brown Owl cannot be expected to visit any place where there is no wood, and then proceeds to say, that on examining the larger ash-trees a particular fungus is sometimes seen growing on the trunk, yellow when young and black when ripe. In process of time the fungus falls off, leaving a very faint mark to show where it has been. But the fungus has absorbed into its own parasitical being the very life of the tree, and the fresh, living wood has become dead, soft, and cork-like. This dead wood may easily be removed with a mallet and chisel, and the hollow adapted for the use of the Owl. The tree will receive no harm, but rather benefit from the operation, as the whole of the diseased portion will be cut away, and the sound wood removed from the influence of the decaying and therefore dangerous part.

The WHITE, or BARN OWL, on the other hand, likes to settle itself near man, and mostly fixes its domicile in some building. Old ruins and towers are very favourite localities for this Owl; and I have seen their simple nests placed in close proximity to a peal of large bells, some of which were chimed daily, and others rung at least once a week. Pigeons and jackdaws occupied the same tower, and all three species of birds lived together in perfect amity. It is also fond of old barns, and is sure to select some spot just under the roof, where it may remain in darkness even throughout the daytime and avoid the brilliant light of day, which has so painful an effect on its enormous eyes.

The Owl makes no real nest, but merely deposits the eggs upon a thick layer composed of the rejected bones, skins, and other indigestible portions of the prey which it has eaten. When first rejected, these pellets, as they are called, look something like small and very short sausages, and are wet and soft. Owing, however, to their structure, they rapidly become dry, and then break to pieces at a slight touch. I have now before me a box full of these pellets, which contain the bones, skulls, and bits of fur that once formed portions of living mice, together with the elytra or shards of several beetles, and the bones, skulls, and feathers of sparrows and other little birds.

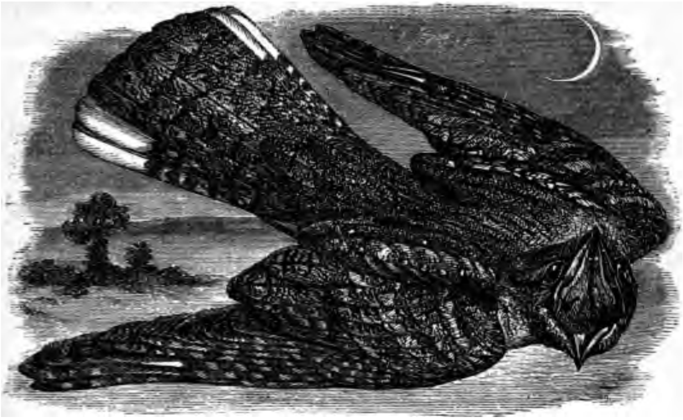
The eggs of the Owls should never be destroyed, as every Owl is worth its weight in gold to all those who have an interest in forcing the earth to yield her increase. If, in course of hunting about a barn, the nest of an Owl should be discovered, by all means let it remain undisturbed. There is no doubt concerning the proprietorship of the nest, for the eggs are very round, pure chalky white, and rough to the touch, as if they had been powdered over with pounded egg-shells. They are rather brittle of texture, and care should be taken that in handling them they are not broken.

Encourage the Barn Owl in every possible manner. If you have a barn or tolerably large outhouse, or, better still, a piece of old ruin, it is easy to make a comfortable domicile for the Owl, by reserving a hollow place about a yard square, shutting it well out from light and the close proximity of man, and leaving a moderate-sized aperture through it that the bird may gain admission. You may be sure that before very long a pair of tenants will have taken possession, and they will pay you such a rent as will reimburse you a hundred times for the pains you have taken to make their house comfortable.

The birds soon learn that they will not be molested, and will allow themselves to be inspected while in the nest, without displaying any signs of discontent. Here they will bring up their little brood, and it is very amusing to watch the comical puffs of white down, with disproportionate bills projecting from their heads, which call themselves young Owls.

The Barn Owl does not restrict itself to mice and small birds, but has been observed to aim at larger prey, and to carry away a full-grown rat just after it fell dead from receiving the contents of an air gun. It has also been detected in the act of catching fish, dropping perpendicularly into the water and snatching up the scaly prey in its claws.

This species may be distinguished from all other British Owls by the whiteness of its plumage.



GOATSUCKER.—*Caprimulgus Europæus.*

In the bird here figured we have another of our best garden friends, though, like the owl and many other benefactors, it has ever received blame in lieu of praise, inspired fear instead of admiration, attracted hate rather than love, and been persecuted by the very persons on whom it confers the greatest benefits.

It is a most determined insect-hunter, its nocturnal habits enabling it to chase and devour the insects which fly by night and remain hidden during the day, and its huge mouth enabling it to seize those larger insects which are most injurious to our gardens.

Ocular demonstration of the services rendered by the GOATSUCKER is easy enough. Walk out after dusk on a warm summer evening, take up your station against the trunk of a tree, or in some place where your outline is masked by some natural object, and then wait quietly. The loud burr of the Goatsucker announces its coming, and perhaps it may fly along on its rapid wings, perch on a branch of the very tree under which you are standing, and resume its extraordinary cry.

I know of nothing that can imitate this cry, nor of any sound to which it can be rightly compared. In former days it was said to be like the humming of a spinning-wheel, but as I never heard a spinning-wheel hum—and I think that there are very few who have done so—the comparison carries no great force with it. It certainly does appear to be the result of machinery rather than of vocal organs forming part of a living being, for the sound is continued uninterruptedly for so long a period, that no ordinary lungs seem to be capable of sustaining it without breaking down.

The Goatsucker is not very conspicuous while on the branches, for it does not sit crosswise, as is the habit of most birds, clasping the bough in its claws, but places itself longitudinally, and there utters its strange cry. The feet of the bird are rather curiously formed, and are adapted for running along the branches, probably to enable it to chase the beetles and other insects on which it feeds. There is a curious lengthening of the middle toe, which has a comb-like appendage attached to it, the use of which is not yet ascertained.

After sitting and buzzing for some time, the Goatsucker will start from the branch and begin a circling flight around the tree, chasing the cockchaffers, moths, and other nocturnal insects that love such situations. As the body of the bird can be plainly seen against the sky, its gestures are visible, and it is very beautiful to see the active bird dart through the air, with a flight that seems to combine the swiftness of the swallow with the versatility of the bat, wheeling in graceful curves, sweeping suddenly upwards and snapping up a passing insect, or reversing its course and setting off in chase of some creature which has passed by.

The number of cockchaffers which it eats is almost incredible. As the cockchaffer is one of our very worst foes to the garden, it will be described in its proper place. Most farmers, however, are aware of the terrible damage which it does during its three years of larval existence, and how it loses nothing of its appetite in its perfect condition, but eats as voraciously as before, stripping trees of their leaves as it had before robbed plants of their roots. And, as the bird catches them just after their emergence from the soil in which they have been hidden, it effectually prevents them from depositing their numerous eggs, so that one cockchaffer slain at that time is equivalent to hundreds killed after the eggs have been laid.

This service alone, not to mention the quantities of the night-flying moths devoured by the same bird, ought to give it its due rank among the best of our garden friends, and should endear it to every one who cultivates even the tiniest patch of ground. As it is known by different names in various parts of the country, I will give a few of the titles which it bears.

It is mostly called Goatsucker, from the ridiculous notion that it sucks goats and cows, an idea which is equivalent to the pigeon's milk so largely in demand on the 1st of April. Curiously enough, the Latin and Greek names of this bird are in allusion to this fabled propensity. As it flies by night, after the manner of the owl, and has, like them, soft plumage and enjoys nocturnal vision, it is called in some places the Fern Owl, the Jar Owl, or the Churn Owl, the two last titles having also a reference to its cry. The resemblance of its note to the humming sound of a spinning-wheel is expressed by the local name Spinner, which is given to it in some places, and another common and very appropriate title is that of Nightjar.

The whole of the Swallow tribe, including the Swifts, Swallows, and Martins, are of the greatest value to the gardener, performing by day the task which the Goatsucker so successfully achieves by night, and devouring insects from the early dawn until the shades of night have closed upon the earth.

Owing to their comparatively small size, they are not able to devour insects of such dimensions as the goatsucker, but they quite equalize the benefit conferred upon us by the far greater number of their victims. They are continually feeding, or carrying their prey to their young. It is astonishing how large a number of insects can be captured and carried off by a Swallow in a single journey. It catches the flies in its mouth, and packs them away in a kind of pouch formed under the chin, where it presses them so closely that when the pouch is emptied the dead insects roll out in a tolerably solid lump, just like currants from a barrel, or figs in a drum.

In order to enable the bird to capture the swift-winged insects, the mouth is made with an enormously wide gape, extending so far into the head that when the bill is open, the bird looks as if the mouth had been slit open with a knife.

HOUSE MARTIN.—*Chelidon urbica.*

The species which has been selected for illustrating this group of birds is a very familiar one, being the well-known Martin, that builds under the eaves of our houses, and by some strange instinct has learned to avoid the open country, and place itself under the protection of man. Happily for itself, the popular superstitions have run in its favour instead of against it, partly because its labours are more conspicuous than those of the owl and goatsucker. It is thought a lucky omen for a house when the Martins build their nests upon it, and as that little superstition has the effect of saving the life of a pretty and most useful bird, I wish that it were extended to many more members of the feathered tribes.

To attract the Martin is not a very easy task. The bird is very capricious in its tastes, and will forsake one part of a building, and take to another, without any apparent reason. That there must be some object in this apparent capriciousness is evident from the fact that the whole colony is unanimous in the accepting or rejecting of a particular wall.

Generally the southern wall is rejected, probably because the hot beams of the meridian sun might crack the mud-built nests, and the favourite point of the compass seems to be the north-east. Yet the Martins have chosen the southern side of my own house for their nests, and although there is a whole row of them on the south wall, not a nest can be found on the other three sides.

Perhaps this choice may be owing to the fact that the eaves are rather long and projecting, and serve to shelter the nests from the mid-day sun. Yet, when one of my friends thought to gratify the Martins by adding a little wooden coverlet to act as a shelter for them, they one and all took offence, and not only declined to build fresh nests, but even vacated those which had already been begun. They do not like smooth walls, and if any one wishes to eject them from his premises, he can easily do so by painting the wall with any oily substance so that the mud will not adhere to it.

Still, although they may cause a little inconvenience, and bring the mop and pail into requisition rather too frequently, they are such pretty and such useful birds, and their young are such engaging little creatures, as they poke their black heads and white chins out of their nests, and look out eagerly for their parents, who are careering in the distance, that very few persons would like to deprive themselves of the sight, even at the risk of a little inconvenience. The little creatures look so earnestly after their parents, they cry so pitifully for food whenever they are hungry (an event which mostly happens about ten minutes after they have been fed), and twitter such rapturous thanks when the expected meal is brought to them, that I, for one, could not find the heart to drive them away.

The contrast, too, between the half-fledged young, with their fat, helpless bodies, their purposeless movements, their ever open and ever screaming mouths, and the light, swift-winged birds of which they were born, and like which they will become in a few short weeks, is so remarkable, that it cannot but arrest the attention of even a careless observer. On the first start in active life they often fail in their efforts, as might be expected from a bird which had spent all its few days of existence in the narrow mud-built cell which constitutes the Martin's nest, and must launch at once into the wide air. It is no uncommon circumstance to catch the young birds on the ground where they are reposing after their first essay at flight, and for the time are not able to launch again into the air. If the reader should happen to meet with such a bird, let him pick it up carefully, take it to an upper window of the house, place it on the sill, and allow it to remain there until it feels sufficient confidence to make another effort.

I once caught a young Martin that had fallen from its nest upon the open window, and had contrived to flutter about in such a strange manner, that it had forced itself between the two sashes, and gave an immensity of trouble before it could be extricated without suffering any injury. It was all in a tremble, and did not attempt another flight for a long time; but at last it spread its wings, shuffled to the extremity of the projection on which it had been placed, and then launched itself off with perfect success. I watched it for a few moments, and, finding that it was gaining confidence and strength, left it to follow its own devices.

The low-flying Swallows, such as the Martin, are, perhaps, more beneficial to our gardens than the Swallows and Swifts, especially the last-mentioned birds, who sometimes soar at so great a height that they look like little black midges playing about against the blue sky. All are equally beneficial to mankind, but those that are of the greatest service to the garden are the species that do not soar to those enormous heights, where the herb-destroying insects are not likely to ascend.

WREN.—*Troglodytes vulgaris.*

WHAT *has* our dear little Kitty Wren done to be encumbered with such a long and ugly-sounding name? The Chimpansee has already absorbed the name of Troglodytes, so e'en let him keep it, and let us have a prettier name for our pretty little bird.

"Vulgaris," again! Why should such an offensive name be chosen for the Wren, which has anything but a vulgar appearance, an idea which certainly is conveyed to the ordinary mind by the Latin term "vulgaris?" The specific name of parvulus, or tiny, has been applied to it by some writers, with more sense of the beautiful, and the name sylvestris has also been given to the little bird. It is the only British species of the genus, and surely a prettier name might have been found for it.

The "Robin and the Wren" have long been united in a rude rhyme, for which they may well be thankful, inasmuch as they are protected, as by the magic runes of the Reim-kennar, from suffering injury at rustic hands. Uneducated man must be ruled by prejudice before he can be guided by reason, as is seen by the ease with which factious demagogues can hold vast assemblies as if they were children in leading-strings; and a word or phrase which appeals to the impulsive part of man's nature will be a thousand times more effectual than one which is based upon sound reason.

You may prove, in the most incontrovertible manner, that the Robin and the Wren are real benefactors to the human race, that they destroy thousands of living insects, and prevent the coming of as many more; yet by all these reasonings you will not induce the rustic to extend to the birds that measure of protection which he gives under the incitement of a couple of doggerel lines, without the least meaning in them, which might not equally well be applied to any other two members of the feathered tribe.

The pretty little Wren is but seldom seen in the open country, preferring to flit along the hedgerows, or to dive among the brushwood in forests, woods, or copses. Small though it may be, it is a very hardy bird, and succeeds in finding a supply of food even through the severe winters. When the ground is hard as if made of flint, when the good housewives are all astir about frozen water-pipes, when the thick ice rings merrily under the skater's steel, the Wren may be seen, still hopping about the hedges, pecking here and there at some object too diminutive to be seen.

Now the minute objects on which the bird has been feeding are the eggs of various insects, that have been laid on the branches so that when the young burst their way through the eggshell, they might find themselves close to the leaves on which they were intended to feed. These little eggs the Wren discovers, as it goes peering into every cranny, and, by its continual researches, saves many a plant and tree from destruction.

It does not, however, restrict itself to insect eggs, but is very sharp-sighted in discovering their chrysalides, which are hidden away in all kinds of corners, awaiting the coming of spring.

Thus its great value consists, not so much in the destruction of insects that are actively noxious, as in the check which it lays upon their increase. Putting the eggs out of the question, as being mostly objects which escape the attention, we can ascertain from practical observation that, together with other small birds, it makes terrible havoc among the chrysalides.

I have in my garden a little preserve of chrysalides of the cabbage butterfly, most of them hidden away very cunningly between the interstices of some unseasoned boards, that have warped, as is the custom with such boards. I purposely left them undisturbed, wishing to see how many would escape the birds. One by one they have vanished, and now there is only a single survivor, whose safety I attribute to the fact that it is placed in a cranny on the interior of a sloping roof, where no foothold can be found for the bird in the very awkward position which it would be forced to assume before it could pick the chrysalis out of its place of refuge.

The beautiful little GOLDEN-CRESTED WREN, or KINGLET—which is, however, not a true Wren—is, in its own little way, nearly as useful as the Kitty Wren herself, though it is not so common, and not so hardy. The bright little being is untiringly active, and it is a pretty sight to watch the tiny pinch of feathers running about the branches of trees, peering into the little crevices in the bark, and then scudding away, as if startled, until it checks itself afresh in its course, and proves by the deliberation with which it examines the tree, that its rapid movements were merely caused by the exuberance of its spirits.

IT will, of course, be impossible, in a work of such small dimensions, to mention every bird, or even every group of birds, that has an influence, beneficial or the contrary, upon our gardens. The plan adopted in this book is to select certain examples as types, and to omit mention of those species which have no particular individuality in their habits. Thus, the whole of the British hawks are represented by the Kestrel, the owls by the Brown Owl, and the swallows by the Martin. We therefore pass over the whole of the warblers, who, in relation to our gardens, may be classed with the finches, and will be briefly noticed when we treat of those birds.

The common Song Thrush has been chosen for separate mention, because it performs a task which, though similar in its results to that which falls to the lot of the wren, is exercised upon different materials. In common with many other birds, the Thrush feeds largely upon insects, and is in consequence entitled to our encomiums, and to be ranked among the friends of our garden. But the special reason for which it is now thought worthy of separate mention, is the incessant war which it wages upon the destructive molluscs which do much harm to our gardens.

Snails, in particular, fall victims by thousands to the hungry and persevering Thrush, and all their instinctive skill of concealment avails them nothing when a hungry Thrush is scouring about in search of food. Neither does the hard shell of a large and venerable snail afford it the least protection; for the bird makes very light of the retreat which is beaten by the snail on finding itself in danger, picks up the doomed mollusc in its bill, and carries it off to its place of sacrifice, where the ground is strewed with many evidences of the daily murders committed there. Robinson Crusoe discovered the sacrificing ground of the savages by the bones and other relics of the slain; and, in like manner, the sacrificial stone of the Thrush may be detected by means of the fragments of broken shells that lie scattered about, the only portions of the snail that the bird declines to eat.

Having carried off its prey to the accustomed spot, the Thrush puts it down for a moment, and contemplates it. Should the shell be thin, the bird breaks it up quickly with its beak; but if it should be thick and hard, as is the case with the older and larger snails, the Thrush picks up the mollusc in its beak, and bangs it against the stone with such hearty goodwill, that the shell is dashed to pieces, and the exposed body of the snail left open to the assaults of the sharp beak.

The Thrush is rather conservative in its tastes—has, as the phrenologists say, the organ of adhesiveness strongly developed—and when it has once fixed upon a stone of sacrifice, it will bring the snails from a considerable distance in order to immolate them at the accustomed shrine. In process of time, great heaps of broken shells are accumulated about the stone, which is sometimes situated in a most exposed locality, such as the side of a public road, or in the very track of a frequented footpath.

The instinct which leads the Thrush to beat the snails against a stone is, however, only an instinct, though it does certainly appear to be as much the result of reason as the nut-cracking propensities of the little monkey in the Zoological Gardens, whose teeth are too weak to crack the nuts that are given to him, and who smashes them neatly with a large pebble. A tame Thrush has been seen to take from the dressing-table of its mistress one of those shell pincushions which are so largely sold at sea-side towns, and to batter it against the hearthstone, hoping to find a snail of some sort inside.

Just as the wren searches after and destroys the eggs and chrysalides of insects, so does the Thrush seek for and kill the snails that have retired from the world and active exercise, and immured themselves, monk-like, in cells of stone or wood. He is mostly obliged to content himself with the smaller kinds of snail, such as *Helix hortensis* and *Helix nemoralis,* because the great garden snail (*Helix aspersa*) has a habit of retiring to its hibernating place in company with others of its own kind, and forming a compact mass, which the Thrush is not able to separate. So, leaving these until the spring, when he purposes to recompense himself for his enforced abstinence, he turns his attention to the smaller species, and drags them easily out of hedge bottoms into which they had betaken themselves.

Concerning the Thrush and the snail, Mr. Knapp, in his well-known "Journal of a Naturalist," relates a very pleasing anecdote. "We observed, this summer, two common Thrushes frequenting the shrubs on the green in our garden. From the slenderness of their forms and the freshness of their plumage, we pronounced them to be birds of the preceding summer. There was an association and friendship between them that called our attention to their actions. One of them seemed ailing, or feeble from some bodily accident; for though it hopped about, yet it appeared unable to obtain a sufficiency of food. Its companion, an active, sprightly bird, would frequently bring it worms or bruised snails, when they mutually partook of the banquet; and the ailing bird would wait patiently, understand the actions, expect the assistance of the other, and advance from his asylum upon its approach. This procedure was continued for some days; but after a time we missed the fostered bird—it probably died, or, by reason of its weakness, met with some fatal accident."

Having now spoken in favour of the Thrush, I must, for truth's sake, admit that there is some basis for the hatred with which many gardeners regard the Thrush, and its dark congener the Blackbird.

Read the correspondents' column in the journals which treat of such subjects, and you will find a whole string of accusations brought against these two birds. They eat the cherries, always selecting the best and ripest (as why should they not, being birds of good taste?), they strip the currant-trees of their fruit, and, in fact, rob the garden as effectually as would be done by a set of schoolboys intent on forbidden fruit.

There is no gainsaying these assertions. The birds are very fond of fruit, know good fruit from bad, and will not touch it unless it be quite ripe. But it must be remarked that, especially in the case of wall-fruit, the Thrush has eaten the snails, which would have not only eaten the fruit, but covered it with slime, and gnawed the leaves and young buds; so that the bird is surely justified in taking some little percentage of the fruit which he has helped to save, and which we ought readily to give.

Still, even if we do grudge him a modicum of fruit, we can easily prevent him from taking it, for his depredations are only carried on for a short time, while the fruit is ripe. We do not speak of those persons who rear the trees for the purpose of selling the fruit and gaining their livelihood thereby, but of those who work in their gardens as an amusement, and yet who have a very great objection to lose all the fruit which they have so carefully watched since the blossoms gave promise of a heavy crop. A net will be an effectual barrier to his progress, and netting is now-a-days made at such very moderate cost, that we may benefit by the Thrush's snail-killing propensities, have the pleasure of hearing him sing, and yet keep all our fruit to ourselves.

Market gardeners are not likely to spare any bird which damages their crops merely on account of its song, but there are many who do not grudge the Thrush a share of their fruit, for the sake of the rich full melody which bubbles from the throat of this accomplished musician. If, therefore, the good and evil deeds of the Thrush be balanced together, we shall find a great preponderance in his favour. The fruit robbery in the autumn is more than compensated by the snail-killing throughout the year, and when the pretty ways and glorious melody are thrown into the scale, the balance is all in favour of the Thrush.

Of the Blackbird we can scarcely speak so favourably, but at all events commend him to notice for his undoubted services in the spring, when he is indefatigable in his search after grubs, caterpillars, and insects of various kinds, and grant to the "Ouzel-cock, so black of hue, with orange tawny bill," his due meed of approbation; and although he may not be so useful a friend to the garden as is the Thrush, let him not be ranked among its foes.

It is with a feeling of some trepidation that we venture upon dangerous ground, and bring afresh the Great Controversy before the public.

Every few years, and with the regularity of an intermittent fever, up starts the great Rook question. Is the Rook injurious or beneficial to the agriculturist? Some practical men take one side of the question, and other practical men take the other side. Both bring forward arguments that seem irrefragable until you hear the arguments of their opponents. They mutually accuse each other of imperfect observation, and both appeal to their eyes as the testimony to their words.

As corn is not generally sown in gardens, we are able to omit that part of the question, and we may confine ourselves to the turf, the turnips, and the potatoe, all of which are undoubtedly cut up by the powerful beak of the Rook.

As to the turf, a colony of Rooks will sometimes frequent it day after day, pecking it up in all directions, and making it look as if it had been treated with a scarifier. There is no mistake about it. The Rooks are caught *flagrante delicto*, and their beaks and feet bear evidence against them.

ROOK.—*Corvus frugilegus.*

But, now that the act has been proved, let us examine its motive. Take a spade, turn over some of the grass at which they have been so industriously pecking, and try to discover what their object can be. You will not long be kept in suspense, for you find the object of their search in certain grubs, some large, very fat, half coiled, and lying on their sides, and some straight, moderately fat, and about the dimensions of a goose-quill. Here we have two of the deadliest enemies of our gardens, the larvæ of the cockchaffer, and of the crane fly, or daddy-long-legs, as it is familiarly called.

of the remains of large larvæ, the hard horny head and jaws remaining as proofs of its true nature. The grass roots are mostly swallowed together with the grub, which has entangled itself in their delicate fibres, and the object of the Rook is not to eat the roots, but to devour the grub that destroys them.

Cunning and bold as is the Rook, so that it can avoid almost any trap laid for it, and will always keep itself well out of shot range (except when it finds that blank cartridge only is used, when it walks about before the gunner with calm assurance), it may be easily driven away from the fields by a very simple process. Alternate rows of sticks should be firmly driven into the earth, and a stout string passed zigzag-wise from one stick to the other. No feathers or streamers are required, as the Rook is horribly afraid of being entrapped, and will seldom venture within the angle enclosed by the strings. These strings should be about seven or eight inches above the ground and drawn tight.

It cannot be denied that the Rook does pull up a large quantity of grass but it is also true that if the bird did not do so, the grass would have been destroyed by the grub, which, if allowed to come to maturity, would have been the progenitor of a numerous offspring.

Also, it cannot be denied that the Rook causes great anger in the mind of the gardener, by pecking up the potatoes which he has set with so much care, and throwing them carelessly about the ground as if in mere wantonness. But, here again, the destruction of the potato has been the secondary and not the primary object of the bird, its real aim being to get at the grub which was feeding on the potato. Turnips again, as every farmer knows, are attacked by a multiplicity of enemies, and in its endeavours to dislodge the grubs, the Rook certainly disfigures the turnip sadly, and makes it quite unfit for sale.

The quantity of insects which a Rook will carry home to its young, is really surprising. In order to achieve this task and to avoid the inconvenience of repeated journeys to and from the fields, the Rook has recourse to a plan similar to that which is followed by the swallow tribe when hunting for a like purpose.

The gathered insects are not swallowed, but are collected in the mouth, where they form a solid lump under the lower jaw, the skin of which is distensible like the cheeks of a man. When the bird has collected its full complement and is flying home, this lump is discernible at some little distance, and has caused the popular but erroneous belief that the Rook is furnished with a pouch at the root of the tongue.

Neither can it be denied that the Rook does often work great damage to the crops, and that it repays itself in kind for the services which it has rendered. And, as in other beings, we cannot expect unmixed good, any more than such a quality can be expected from ourselves, we ought to balance the good against the evil, and in our own little court of justice to follow the British maxims; that the accused is to be treated as innocent until he is proved to be guilty, and that in any doubtful case he is to have the benefit of the doubt.

WITH the rook may be ranked the CROW as a friend to the gardener, though I should be sorry to plead for him as a friend to the game preserver or to the poultry-keeper.

Of course, the popular name of Carrion Crow is a misnomer, inasmuch as the bird would have but small likelihood of surviving if it were restricted to carrion in its "struggle for existence."

Still, it is essentially a feeder on animal substances, and makes great havoc among the insects which depopulate our gardens. It has a very accommodating appetite, eating mice, frogs, lizards, insects, and molluscs, robbing the nests of other birds and carrying off both eggs and young, visiting the water's edge and picking up the various aquatic creatures that venture near the banks, or even taking expeditions to the seaside, and feeding luxuriously on the crabs, shrimps, and marine worms and molluscs. To the game preserver it is a deadly foe, and in his book is always classed among the numerous beings that he considers as "vermin," for it pounces upon the young pheasants and partridges, and occasionally seizes a favourable opportunity of delivering the death-blow to a stray leveret.

CROW.—*Corvus corone.*

To the poultry-keeper it is scarcely less obnoxious, inasmuch as it has a great liking for very young chickens or ducklings, and has been observed to carry off nine successive ducklings to a single nest. But as this little work is written for the use of gardeners, without reference to any other pursuit which they may follow, it is but right to include the Carrion Crow among the list of our friends.

We ought not to pass over the **Starling** in our list of garden friends.

The farmers have now begun to acknowledge that, to their fields and flocks, the Starling is an invaluable benefactor, and have ceased, for the most part, from the deadly persecution with which they assailed this handsome and most useful bird. You may see the vast flocks of Starlings winging their way through

the air, in compact and orderly masses, evidently under the command of some leader, each body dashing forward as regularly as a regiment of cavalry, wheeling, spreading themselves, reassembling, rising, and descending in perfect union. Suddenly they make a circuitous flight over a field, mostly where cattle or sheep are grazing, stoop downwards, and, with a rushing sound of many wings, settle upon the grass.

STARLING.—*Sturnus vulgaris.*

Take the telescope, and watch them, and you will see that they are all busily at work, some picking up the flies, beetles, and other insects that are creeping among the grass or tormenting the cattle, and others freeing the sheep from the so-called "ticks" which run riot among their fleeces.

The only cause of enmity to the Starling which the farmer can now bring forward is, that he believes his pigeon-cotes to be

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assailed, and the eggs sucked by this bird. Now, in truth, the Starling has no idea of sucking the eggs of pigeons or of any other bird; and though it is fond of establishing itself in the pigeon-cote, it only does so because it finds a congenial shelter for its rudely manufactured nest. The pigeons bear no enmity towards the bird, but associate with it in perfect amity.

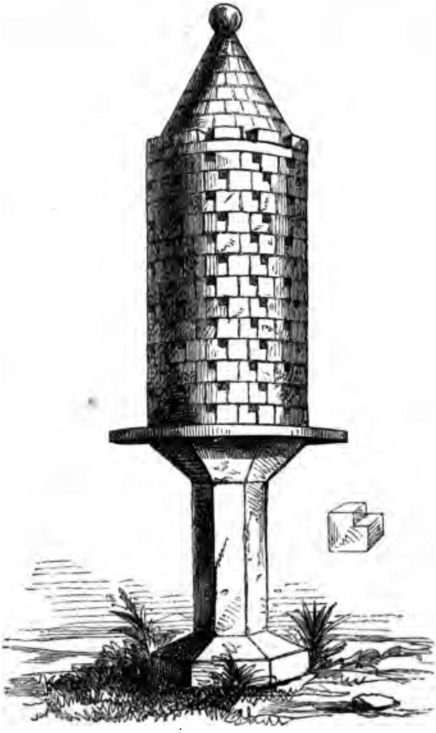
Putting aside, however, the influence which it exerts upon the farmyard and the meadows, let us see what may be the effect of its presence upon the garden.

Apparently, the Starling seldom makes its appearance in the garden, for, though it is so far a lover of man as to congregate in cities, and build nests under the shelter of houses, it mostly goes far a-field to seek its food, and spends the greater part of its day in the open country. But, in the very early morning, before the generality of mankind have opened their eyes to its brightness, the Starling pays its visit to our gardens, especially favouring those which can boast a lawn, and there may be seen upon the grass, busily feeding away among the blades.

Like the rook, it comes to seek for subterranean grubs, and is wonderfully keen at discovering and unearthing the larvæ of the daddy-long-legs, as they creep their stealthy way through the soil, gnawing and destroying the roots of the grasses, and leaving barrenness and destruction in their path. Only in the early dawn will the Starling remain within the garden—at all events, in those cases where the lawn is in close proximity to the house; and when the sun begins to cast a shorter shadow, the Starling takes wing for the fields, and there remains throughout the day, except when it brings back provisions for its young and very noisy brood.

Every householder in the country ought to encourage the Starling to build its nest in his neighbourhood, and to enlist its services in clearing his grounds of noxious insects. Nothing is easier than to attract the Starlings. If you can do so, build them a tower for their special accommodation, and you will have every aperture peopled by the ensuing spring. The accompanying sketch shows the method that has been so successfully employed by Mr. Waterton for this purpose. There are two of these towers at Walton Hall, and both are crowded with inhabitants.

In order to prevent cats from climbing up and thrusting their lithe paws into the nests, and to form an effectual barrier to such stealthy foes as rats, weasels, and stoats, the inhabited part of the edifice rests upon a stone pillar, crowned with a large flat slab that projects boldly on every side, like the staddles on which a rick is built. Of course, the pillar must be of sufficient height to prevent a cat from leaping upon it.



Upon this base is reared a cylindrical stone tower, pierced with a multitude of apertures, made by the simple process of omitting stones. These holes should be of some depth, to suit the idiosyncrasy of the Starling, which likes its nest to be dark and well sheltered.

As, however, the crows, magpies, and other winged foes might make sad havoc among the eggs and young, were the holes left entirely open, Mr. Waterton has invented an equally ingenious and simple method of prohibiting the entrance of any but the rightful owners. The entrance to each hole is closed by a square stone, which fits loosely into the aperture, so as to leave plenty of room behind it. One corner of the stone is chiselled away, as shown in the smaller figure, so that the Starling is able to gain access to the nest, while neither crow nor jay nor magpie can reach it. As the stone is quite loosely fitted, it can be hooked out at any time by means of a bent iron rod, thrust through the opening; and thus the condition of the nest can be at any time examined. The birds soon learn to comprehend that they will not be injured, and permit themselves to be inspected without showing the least sign of fear.

Brick will, of course, answer the purpose, if the garden should be in a non-stone-producing locality, and, if entrusted to an architect of good taste, a very pretty and picturesque design might be produced, uniting beauty with usefulness. Should, however, both brick and stone be impracticable, the Starling may be attracted by a wooden edifice, made like a pigeon-house, but with much smaller entrances to nests. Even isolated boxes, such as are sold by the bird-dealers for the use of canaries in the building season, will prove attractive; and any one who will exercise some little ingenuity, and take some little trouble, will be able to have a colony of these beautiful birds close to his house.

No devices are needful to attract them. Make some houses for them, and they will find occupants. Mr. Waterton mentions, in one of his essays, that, for many years, only two pairs of Starlings remained in the island on which the house is built; one pair having found a resting-place in the roof, and the second pair having taken possession of a hole in a sycamore-tree. Yet, after a number of burrows had been made in an old ruined gateway, and one of these towers built in close proximity to the river, a flock of Starlings took up their residence, and have built their nests from year to year in the same habitations. A second tower, placed in another part of the grounds, met with a similar acknowledgment on the part of the Starlings; and I have no doubt that, if a hundred such towers were erected, they would all find occupants before the expiration of a year.

I mention these circumstances for the purpose of showing the readiness with which birds may be attracted by those who have studied their habits and know how to suit their idiosyncrasies.

We now pass to the great group of the Finches, in which are included a very large proportion of the "little birds" of our island.

The "Little Bird Controversy," is nearly as celebrated as those upon the rooks, and turns on the same question, namely, the effect of the birds upon the crops.

As in the instances which have already been mentioned, there can be no doubt but that the Sparrow, in common with many other little birds, is sometimes very destructive towards the crops, but there is equally little doubt that its destructive capacities are not limited to the crops, but to the beings, both animal and vegetable, which are injurious either directly or indirectly to those crops.

The Sparrow has often been seen to nip off the young buds of trees, though it is not very easy to know whether those very buds had not been attacked by the grub.

Even in the case of flowering trees, which we cherish in our garden, the Sparrow is sometimes of great service, as is shown by an anecdote related by Mr. H. D. Richardson:—"We once saw a Sparrow hopping from branch to branch of a rose-tree, bearing it down and fluttering his wings for a minute, then hopping to another and performing the same seemingly unmeaning prank. Wondering what could be his object, we watched him, and observed that he went from branch to branch until the whole had been practised on, without attempting to pick one atom of food. He knew, however, what he was about. The tree was infested by the leaf-rolling caterpillars. Had he gone to each leaf, the vigilant caterpillars would have slipped out at the other end and eluded his grasp by dropping to the ground. He shook the leaves, and scared off all the caterpillars, who let themselves down by their silken webs; and he then deliberately picked them up from the ground, appeased his appetite, and so flew off, doubtless to his nest, with a well-stored beak."

I select this anecdote and give it in the words of the narrator, because it affords a good example to the proprietors of gardens, and teaches the use of careful observation. A careless person might have seen the Sparrow hopping about in the rose-tree, and not have thought that the bird was performing any task at all, or perhaps might have imagined that it was there for the purpose of eating the young buds. Another might have seen it on the ground under the rose-tree and have observed nothing peculiar in its movements. But the close and careful observer watches the bird throughout its little performances, and then learns its object from a series of movements which apparently were actuated by no particular motive.

Allow me again to offer a little advice which I have ever given to those who possess gardens, or who are fond of watching the habit of animals. Let a thoroughly trustworthy telescope or double field-glass be procured and always kept at hand. I possess two such aids to vision, one a powerful telescope and the other a double field-glass, and have them conveniently placed in the window with a general focus ready adjusted, so that either can be used at a moment's notice. Being an early bird myself, I can watch the feathered tribes as they come out of their roosts and rejoice in the first rays of the dawn, fearless of man, who, at that bright hour, is, as a general fact, stewing himself slowly in bed, and would think it a terrible hardship to be forced to enjoy that unpurchasable luxury, the fresh inspiriting air of sunrise.

Under my window the Sparrows come in successive troops, hopping and fluttering over the lawn, and pecking away at every hop. They are not eating grass, but the insects which feed on the grass, and succeed occasionally in pouncing on a too confident grub, which has put its head out of its burrow during the darkness, and forgotten to retreat, until the strong bill of the Sparrow renders retreat impossible, and hauls the heedless creature from its home.

The proprietors of gardens have a special reason for gratitude towards the Sparrow. Gooseberries are a favourite fruit, whether fresh or preserved, and we are too often doomed to see our trees lose their leaves, and the crop of fruit fail, solely through the attacks of the gooseberry-fly, the dark grey grubs of which are so plentiful and so voracious. These grubs are very pleasing to the Sparrow's palate—though, by the way, it seems rather strange that a bird should have any particular sense of taste, considering the formation of its mouth and the substances on which it feeds—and accordingly are killed in great numbers by that indefatigable bird. For many successive days the Sparrows may be seen filling their beaks with gooseberry grubs, and bearing them off to their young.

The wireworm, again—a pest that is perhaps more universally dreaded than any other of the insect tribes—is a favourite food of the Sparrow; and it has been well calculated that, though the Sparrow is said to eat a bushel of corn annually, it saves a quarter by its depredations among the insects. The Sparrow, in fact, has recourse to that most effectual system for ridding the plants of the destructive insects which, when performed by man, is termed "hand-picking," but which cannot be achieved by man with one hundredth part of the success that attends the bird.

The bird can go where man's superior size forbids him to pass. It needs not to stoop to the ground to find the low-lying insects, and can examine every leaf of a tree without needing artificial support. It has eyes far more penetrating at a short distance than those of man, and a beak that can be inserted into crevices which his fingers refuse to enter.

The search is no task to the bird, and involves no such labour as it entails on man—it is rather a pleasure, the carrying out of an instinct; and the keen eagerness with which it hunts for its prey is somewhat analogous to the hunter instinct which holds so large a place in the human nature. Hunger, too, acts as a powerful incentive; and no one who sees the joyous gestures, and listens to the low but lively chirrup of the bird while hunting for its insect prey, can doubt that it feels intense gratification in the pursuit.

Not that the Sparrow is not an eater of corn and other seeds. It certainly transgresses largely in that respect. It is terribly apt, for example, to watch the newly-opening crop of peas, and to nip off the green shoots just as they show themselves above the ground. But, even in its seed-eating propensities, it does good to the gardener. It is very fond of the seeds of the groundsel, the dandelion, and the sow-thistle, all of which plants are nuisances in a garden, though they doubtless fill some useful office in their proper places, wherever that may be. Every gardener who has been unfortunate enough to come into a domain that has been neglected for two or three years, where the weeds have been allowed to take root, to seed, and to sow the ground beneath them with an abundant crop of weeds for the coming season, will feel very grateful to any creature that will aid him in lessening the numbers of these annoying weeds.

Some time ago, a series of letters were addressed to the *Times* upon this subject, the general tone of which was in favour of the little birds. Not to occupy too much space in a book which must comprise a very great number of subjects, I will only give a single letter relating to the bird whose garden history we are now examining.

A correspondent, who dates his letter from the vicinity of Liverpool, writes as follows:—"Here there have been on the part of the farmers and cottagers great complaints made of the mischief done by small birds to corn-fields and gardens. In vain did some hold the argument that these small robbers did as much good in destroying grubs and caterpillars as harm to wheat and currants. For the last two years the township has not only paid for dead Sparrows, but so much a dozen for birds' eggs. I am afraid to say how many thousand dozens of eggs were taken and paid for. And as I believe, mainly in consequence of this, we have this year such a plague of caterpillars and grubs as I never remember. I have had three women constantly employed picking our gooseberry, currant, and apple-trees, and our destruction of caterpillars has been by bushels.

"I felt so convinced that this plague was partly owing to the last two years' destruction of birds, that in my own grounds and in all the coverts I ordered the nests not to be molested. I now enclose you the head of a Sparrow, shot this morning in my garden. This was done to test what food it did take to its nest. I hope the head may reach you in the same state in which it was picked up, viz. with three green caterpillars and three daddy-long-legs in its beak. If in one journey from its nest it could collect as many, it is easy to guess how much may be done by them to clear trees. My trees, from hand-picking, are now pretty clear, but I am quite sure it would have been done cheaper and better by birds had they been let alone."

The green caterpillars mentioned in this letter were probably the larvæ of the small cabbage-butterfly, a most destructive species, of which we shall speak in its proper place.

Another correspondent writes to say, that he found in the crop of a Sparrow that he shot as it was coming out of his fruit-trees, no less than twenty green caterpillars and a number of aphides. Many such letters were written, not only to the *Times*, but to the *Field* and other newspapers, and mostly having the same tendency.

If there is one abomination beyond another, and one which more especially calls for the reprobation of the public, it is the use of poisoned wheat, and the other compounds which are laid about for the purpose of destroying the small birds. I say nothing against their success, if their murderous object can be called by such a name. They are only too successful, destroying the birds by hundreds in an indiscriminate massacre. Eight hundred birds have been destroyed at a single dressing of the ground with poisoned wheat, and their murderess—for I regret to say that the owner of the grounds belonged to that which we call the gentler sex—was so inspirited by her success, that when the writer of the epistle dated his letter, she was preparing for a second battue. I purposely omit the name of the locality in which this massacre took place.

Bad enough would it be if the mischief were confined to the death of those birds for whom the treacherous bait was laid. The poor birds do not all die on the spot. Many of them retain sufficient strength to fly away to some distance and then fall dead, some in the hedges, some in the fields, and some in the open road. Their carcases are often found, and torn or even eaten by dogs; and loud and bitter are the complaints made by the owners of hounds against those who have employed the abominations of poisoned food against the birds, and indirectly caused the death or serious illness of their dogs.

Game, too, has often fallen before the poisoned wheat, and the sportsman has equal reason to execrate its employment.

Here is a paragraph extracted from one of the weekly newspapers, which will give an idea of the mischief done to agriculture by sheer ignorance.

"The —— *Gazette* mentions that on the 5th instant the annual meeting of the —— Sparrow Club was held, and upon examination of the accounts it appeared that 3,999 sparrows and 3,262 other birds—total, 7,261, had been destroyed in the past year. Prizes were awarded to the three members who had destroyed the greatest numbers, and it was resolved to continue the club another year."

Seven thousand small birds murdered in one year in one locality! Why, at the very smallest computation, these birds would have destroyed more than twenty millions of caterpillars, grubs, and other noxious creatures during the breeding season, performing thereby a direct service to the agriculturist. And their indirect services would have been still greater. For, by destroying these beings before they arrived at their perfect state, they prevent a future increase of them, and aid in clearing the vegetation of these marauders, just as a gardener clears his ground of weeds by cutting them down before they can produce seeds.

Prizes for killing the greatest number of birds! The next improvement will be to give prizes to those who collect the greatest number of caterpillars, weevils, grubs, wireworms, slugs, and snails, and turn them into the fields and gardens. The two acts are identical in their results, and one is as deserving of a prize as the other. Why not give prizes to those members who could show the greatest amount of smut in their wheat, or the greatest amount of disease in their potatoes? It would be quite as rational a proceeding. Or, why not offer a prize to the member whose turnips were most devoured by the fly, or whose corn most blighted by the wireworm?

The whole paragraph really makes me stand aghast at the inconceivable folly of those who ought to know better. Destroy the birds, our best friends, who fight for us against the destructive insect hosts! If an invader were to throw a powerful army upon our shores, and threaten destruction to our country, I believe we should think that to shoot all our own soldiers would be a strange method of repelling him, though it would be quite as sensible a plan as to preserve our crops by shooting the birds.

I have purposely removed the name of the Sparrow Club whose atrocities have just been mentioned, hoping that its members may learn wisdom, amend their ways, and fine any one who shoots a Sparrow or a goldfinch. I shall take care that a copy of this book be sent to the secretary; and if it may have the effect of thinning the members of the Sparrow Club, and increasing the number of the Sparrows, I shall think myself well repaid for my trouble.

IN the GOLDFINCH we welcome a bird most lovely of colour, sweet and gentle of voice, and peculiarly useful to the garden. It inflicts scarcely any damage upon the garden produce, to counterbalance the services which it renders, and devours large quantities of the smaller insects. It is not very often seen in the garden, and perhaps does little direct good to any individual garden, but at all events it destroys thousands of insects which would otherwise fly about and spread themselves equally over garden and field.

It is a great seed-eater, but prefers those plants which have downy or feathered seeds, such as the dandelion, the groundsel, and the thistle, all of which plants are reckoned as weeds and watchers will always put stones in the gun or pistol, if shot be not allowed to them.

Nothing, perhaps, is so effectual in driving the birds away, without inflicting personal injury upon them, as to fire a few charges of shot among them now and then, from a long distance, so that the shot may rattle about them, and convince them that they are not out of reach of the noisy weapon. One or two such discharges during the day will be quite sufficient to give the birds the needful warning, and thus a double service will be rendered—the birds will be kept off the crop, and the gun will not be scratched to pieces by firing stones instead of shot.

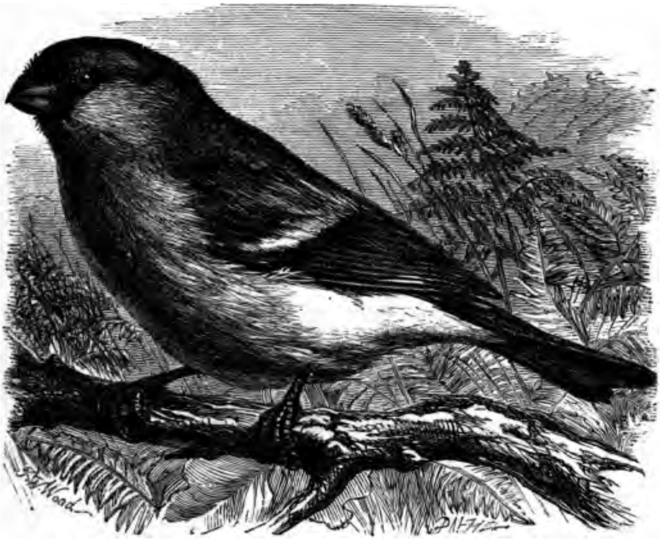
Old government muskets are in great demand for this kind of work, for which they are well adapted, as they make a tremendous report, are not likely to burst, and throw a charge of shot with sufficient accuracy.

There is a way of protecting peas from the birds which has certainly been very effectual in my own garden. At each end of the drill a wooden arch is fixed into the ground, and strong white thread is passed backwards and forwards, so as to form a continuous tunnel or passage. The birds are afraid of the thread, which also serves as a support to the peas, when they grow to four or five inches in height. If my own peas suffer, I shall lay the fault on my cat, who thought that the thread had been placed there as a plaything for him, and pulled one of the tunnels to pieces in his gambols.

I FEAR that I can say but little for the BULLFINCH, although I have a great personal admiration for the jovial, handsome bird.

It helps itself most liberally to the buds of trees, especially of those that bear fruit, and by a sort of moral obliquity prefers those buds which were intended hereafter to bear fruit, so that the leafage of the tree suffers little injury. It certainly has happened, that when a tree has thus been apparently disbudded, it has afterwards produced a heavy crop of fruit; but such a piece of good fortune as this cannot always be expected. It has a peculiar liking for orchards or gardens where fruit-trees are grown, and often falls a victim to the angry gardener's gun.

Events have proved, that whatever may be the effect of individual species upon the crops, the finches and warblers are among our best friends. We know from many reports how it has been found necessary to reimport the small birds into countries where they had been nearly extinguished, on account of the swarming of insects of all sizes, which ate up the crops, and defied the power of man to destroy them. I do not mean to weary the readers of this little work with an array of figures, such as can easily be got together, and have a very business-like appearance, but merely state, hardly without entering into needless details, that which has been proved to be a fact, namely, that the little birds are our best friends.



BULLFINCH.—*Pyrrula rubicilla.*

I believe that Mr. Waterton was among the first, if not the very first, to discover this fact and to act upon it, and he has done so in a manner that certainly gives the birds fair play, and the theory a searching test. He permits any bird to enter his garden, and eat anything it likes, without allowing it to be disturbed.

The natural consequence is, that the birds absolutely crowd into his domain, where they have learned, by the traditionary lore of fifty years, that they will be welcomed without deceit, that they will find food without stint, and that they will not even be disturbed in their proceedings. If, therefore, their presence were as injurious as is popularly supposed, all the tribe of finches would alone suffice to render the garden a waste and the orchard a mere clump of barren trees. But the result is precisely in the contrary direction, for the crops are plentiful, and the orchards bear their annual fruits in abundance.

BLUE TITMOUSE.—*Parus cœruleus.*

The Titmice, though ranked by ignorant people among the worst of our garden foes, are in reality to be placed among the most valuable of our garden friends.

Hundreds of these pretty and happily plentiful birds may be seen among the branches of the fruit trees, pecking away with right good-will as they traverse the boughs, and apparently making much havoc among the buds. You may see them peck at a bud, twist it off its twig, nibble at it, and then fling it down; and if the little bird be watched carefully, it will be seen to repeat this process with wonderful rapidity.

This being the case, the generality of agriculturists imagine that the Titmice are disbudding the trees, and add its name to the black list of the many creatures which they ruthlessly slaughter, considering them to be injurious to their crops. Proprietors of orchards are especially subject to this delusion, and, as a general rule, hate the Titmice, and wreak vengeance upon them whenever they can get them into a trap, or within range of gun. Yet the little birds are, in truth, performing services beyond all value and surpassing all calculation. They are not feeding upon the buds, but on the insects within them.

The Titmice are all lovers of animal diet; it seems to be absolutely necessary for them. Their natural food is to be found on the trees and among the herbage, and consists of all the multitudinous insects that, if allowed to multiply unchecked, would devastate our crops and wither up our flowers.

If they cannot obtain their amount of animal food in the natural manner, they are driven to do so in a fashion which confers no benefit on mankind. They prowl about the farmyard, and peck the bones which the dog has not eaten. They snap away the oil and grease and soap which are required in the stabling department. They hover about knackers' yards, and are not above prowling round the kennel, looking out for their share of the dog's meat. Butchers' stalls, too, are frequented by this impudent little bird, which will pounce upon and carry away little scraps of meat or fat while the butcher is looking in another direction. Or, in default of all these resources, it will fall foul of other birds, seize upon young and helpless nestlings, batter their heads to pieces with its small but powerful beak, and feast daintily on their flesh.

Let, therefore, the Titmouse be permitted to follow its avocations as it chooses, and to range the fruit trees, fields, and gardens unchecked. For, in truth. the little bird is working with all its might in our behalf, and is attacking our worst pests at their very root and source. Its microscopical eye discovers the eggs of noxious insects which have been deposited in spots where they will find plentiful nourishment when they are hatched, and in half-a-dozen pecks it will destroy the whole future brood. The eggs of the terrible leaf-roller caterpillar, so tiny but so destructive, are devoured in vast numbers, as are those of that plentiful nuisance, the little ermine moth.

Even the eggs of the saw-flies cannot escape its sharp eyes, hidden as they are in those living cradles which the potent weapons of the mother-insect force the plant to prepare for the creatures that are so soon to devour it, compelling it, as if by magic spells, to protect, during their nonage, the very beings that are destined to rob it of its foliage in their passage to maturity.

In the depth of winter, when it has thoroughly investigated the trees, and can find nothing more to eat upon their branches, it has recourse to the stacks and thatched buildings, pulling out the straws and eating the insects that are found in such localities. As every entomologist knows, there are several insects which make their nests in the interior of straws, and these are, in some degree, the objects of the Titmouse's search. Sometimes, it is true, the bird works so very hard at this business, that it damages the thatch in no slight degree; and there have been instances known where the services of the thatcher have been needed in order to make the roof weather-tight, after the assaults of the Titmice.

All these birds are very prolific, laying on an average about nine or ten eggs, and bringing up two broods in a season. They remain in company for a considerable period after they are able to fly, and the whole family may be seen flitting over the branches in company, uttering their pretty little twitter, and looking the very picture of happiness as they trip over the branches. Their feet are so strong, and their limbs so nimble, that they really look more like mice than birds as they run over the boughs, earning well their popular and appropriate name of Titmice.

In the summer-time, the Titmouse works as well as it did in the winter, but its labours are then more conspicuous, and better appreciated. Having to feed an enormous and ever-hungry little family, the Titmouse searches after those insects which have survived the many dangers of their egghood, and destroys vast quantities of caterpillars, flies, and grubs. It has been calculated that a single pair of Titmice destroy, on the average, no less than five hundred of these garden pests daily, achieving a work which could scarcely be surpassed by a man who gave his whole time to the same pursuit.

Moreover, the man could not be as successful at so small a cost; for, setting aside the value of his time, and the amount of a labourer's daily wages, he could not reach the denser and loftier twigs on which the caterpillars revel, and which the Titmouse can traverse with perfect ease. No man can investigate a tree, and clear it of the insect hosts that constantly beleaguer it, without doing some damage to the buds and young leaves by his rough handling; whereas, the Titmouse trips daintily along the branches, peeps under every leaf, swings itself round upon its perch, spies out every insect, and secures it with a peck so rapid that it is hardly perceptible.

As to the offence of picking off the buds, a delinquency of which the bird is undoubtedly guilty, I have already mentioned that, in most cases, and perhaps in all, the bud is already doomed, being the home of some insect too small to be detected by man, but yet unable to escape the eye of the bird. Several gardeners say that the bird does better service by nipping off the bud entirely than by simply eating the insect and letting the bud remain on the branch, and that it achieves a kind of natural pruning that causes the tree to throw out fresh and healthy buds in the place of those that were diseased.

Among the eight species of Titmice which are found in this country, two are of especial service to the gardener, as being most plentiful and most familiar. These are the common Blue Titmouse, figured on page 66, and the LONG-TAILED TITMOUSE (*Parus caudatus*), so celebrated for the beauty and remarkable form of its nest.

The other species do not seem to venture so fearlessly into the garden as these little birds. The GREAT TITMOUSE (*Parus major*) may, however, be frequently seen in the garden, hopping and pecking about the trees in its search after food. This species is particularly addicted to the straw-pulling habits which have been described, its greater size and strength enabling it to perform tasks quite beyond the powers of the lesser species.

Let me, therefore, commend the whole of the Titmice to the best care of the gardener, under the assurance that in them he will find his best friends. Above all things, let him set his face against any such "Sparrow Clubs" as those of which an account has already been inserted, where prizes were given to the members who had killed the greatest number of little birds (Titmice among the rest), where the murdered benefactors of the garden might be numbered by the thousand, and where the club announced its intention of prosecuting another campaign in the ensuing year.

On the Continent, where anything that wears feathers is counted as game, and birds of all kinds are sold in the market, there may be some excuse for a wholesale slaughter. But in England we do not eat Titmice, buntings, wagtails, nightingales, swallows, starlings, wrens, and many other birds beside, which are regularly sold in Rome for the table; and our only motive for killing them is one for which there is no excuse whatever.

IN the WOODPECKERS we have fresh examples of friends which have been reckoned as foes.

Even at the present day, the presence of a Woodpecker in the garden would be looked upon with great suspicion, and the very sight of the hole which it makes in the tree-trunk, would be considered as sufficient evidence of its mischievous propensities. It is but seldom that the Woodpecker is seen in our gardens, but as it does make occasional visits there, its true character ought to be known.

The ordinary idea of the Woodpecker is, that it bores holes into healthy trees, damaging them exceedingly by the process, and that, therefore, it is an injurious bird to our orchards. Now, a very slight knowledge of the habits of the bird is sufficient to prove, that so far from being hurtful to the trees in which it bores, it is rather beneficial, serving to clear away decaying wood, and to destroy the many insects which find a harbouring place under the bark, and which send forth their destructive hosts to wage a never-ceasing war upon the trees of the forest, as well as upon the herbs of the field.

GREEN WOODPECKER.—*Gecinus viridis*

Every one who has examined the trunk and chief branches of a very old tree, knows how the rough bark acts as a sheltering place for all kinds of insects, and how hopeless is the task of extirpating them. This feat, however, is performed by the Woodpecker, who scales off the bark by well-directed strokes of its beak, and with its curiously-formed tongue seizes and draws into its mouth the tiny insects which have been lurking beneath in fancied security. I have often wondered what must be the thoughts of the minute beings, when their destroyer is at hand. Whether they recognise it as a fellow-creature with themselves, or whether they look upon it as we look upon a suddenly fatal disease, something vast, incomprehensible, unavoidable, an incarnation of fate, a visible manifestation of something infinitely beyond and above themselves. The Woodpecker is fond of the aphides, those wonderful green insects, so interesting to the naturalist, and so objectionable to the gardener. It finds them crowded on the tree-branches, and with its lithesome tongue sweeps them to instant death. This bird deserves gratitude, also, for its persevering destruction of those eccentric little beings, known popularly by the name of woodlice, and which are found in vast numbers, crouched beneath the sheltering bark. The depredations which these creatures commit will be narrated when we arrive at the class to which they belong.

Nor does the bird do any harm to the tree into which it bores its way. I do not think that a Woodpecker ever troubles itself to bore into a perfectly sound tree, and believe that only in those cases where the wood is already decayed from some cause or other, does it scoop its curious tunnel. The decaying state of the wood is often quite invisible to the ordinary eye, and even if attention be drawn to it, very few would be able to see its true condition. Insects, however, find it out, and come and burrow in it, thereby letting water into the very heart of the tree, and sapping it to the roots. Very seldom does the Woodpecker visit our orchards or gardens, preferring the forest and the wood, where it is not likely to be interrupted by man, while performing its noisy task. Yet, as it destroys insects, and other creatures which attack trees of the orchard and garden, equally with those of the forest, it has a right to be ranked among our garden friends. There are several other species of British Woodpecker, from which the Green Woodpecker has been selected, as being the most common and the best known.

There are but few species of Pigeons in England, although there is a host of varieties, more or less permanent, and, as far as is known of their habits, they may be reckoned among the neutrals. They do great damage to the turnips, a plant of which they are peculiarly fond, and they eat away the best shoots of

WOOD-PIGEON.—*Columba œnas.*

the young clover, a plant, however, that is seldom cultivated in gardens, except as an accessory to the lawn. The **Ringdove** (*Columba palumbus*), is a terrible bird to eat turnips, and fills its crop to such an extent with the grateful food, that its whole shape is altered, and even during flight it is very easy to know whether the bird has made a successful forage or not.

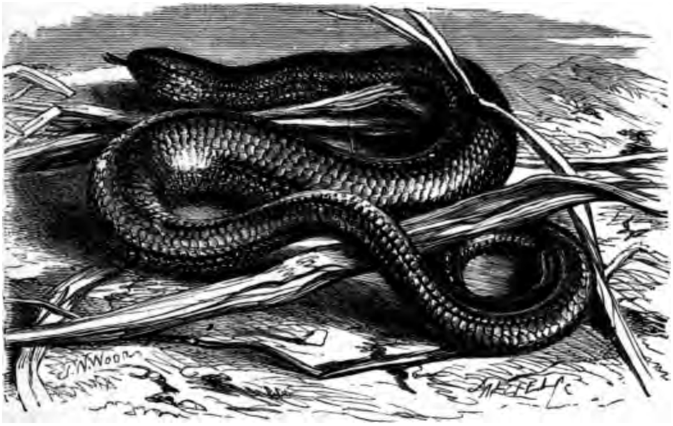
Still, although the Pigeons are strangely voracious birds, considering the reputation which they bear, they are not without their uses. In Mr. St. John's "Sketches of the Highlands," there is the following passage:—"An agricultural friend of mine, pointed out to me the other day an immense flock of Wood-pigeons, busily at work on a field of young clover, which had been under barley the last season. 'There,' he said, 'you constantly tell me that every bird does more good than harm, what good are those birds doing to my young clover?' On this, in furtherance of my favourite axiom that every wild animal is of some service to us, I determined to shoot some of the Wood-pigeons, that I might see what they were actually feeding on, for I did not at all fall into my friend's idea, that they were gorging on his clover.

"By watching in their line of flight from the field to the woods and sending a man round to drive them off the clover, I managed to kill eight of the birds as they flew over my head. I took them to his house, and we opened their crops to see what they contained. Every Pigeon's crop was as full as it could possibly be of the seeds of two of the worst weeds in the country, the wild mustard and the ragweed, which they had found remaining on the ground, these plants ripening and dropping their seeds before the corn is cut.

"Then no amount of human labour and search could have collected on the same ground, at that time of year, as much of these seeds as was consumed by each of these five or six hundred Wood-pigeons daily for two or three weeks together."

Sometimes, especially in severe weather, the Wood-pigeons congregate in immense multitudes, nearly ten thousand having been observed in a field of twelve acres. It is evident, therefore, that when such a flock as this has to be supplied with daily nourishment, the substances which the Pigeons eat are of no small importance to mankind, and that their influence for good or for harm is sufficiently important to deserve our closest attention.

Taking Mr. St. John's maxim literally, and following it up to its inevitable conclusion, we should be obliged to acknowledge that even mice and rats are useful to the land, and ought not to be destroyed, though they may be checked in their depredations. As to the rats, it is true that in their proper place they are extremely useful and cannot be spared; as, for example, when they take up their abode in sewers, feed largely on the various animal substances that find their way into such localities, and attain to such huge dimensions, and to such a ferocity of spirit that they seem to be almost of a different species to the barn rat. So well is this fact known, that in the "ratting" matches so popular among sportsmen, sewer rats are never allowed to take part in the contest when the owner of the dog knows his business. This is rather fortunate, as it serves to remove the rats from barns and other places, where they are only destructive intruders, while it offers no hindrance to them as long as they remain in the sewers. In Mr. J. Rodwell's work on the rat (published by Messrs. Routledge), there is an amusing account of a "ratting" match, where the two parties each bribed the rat-catcher, the one who backed the dog ordering him to bring small barn rats, and the other who took the opposite side bribing him to procure the largest and oldest sewer rats. The man, being very honourable, according to his own sense of that quality, balanced the amount of the bribes, and finding that he had received one sovereign from the dog owner, and two sovereigns from the rat backer, he procured one dozen barn rats, and two dozen sewer rats.



BLINDWORM.—*Anguis fragilis.*

CHAPTER IV.

The British Reptiles, their Numbers and Uses—The BLINDWORM—Its true Place in Nature—Its Harmless Nature—The popular Dread of the Blindworm—Its Teeth and their Use—Its Food and Services to the Gardener—Hibernation—Its General History—The SCALY LIZARD—Its Mode of Life, Habitation, and Food—Its Use in a Garden—The SAND LIZARD—Difficulty of keeping it Alive—A proposal for a Lizard House—Wild Nature and its Beauty—Description of a Curious Garden—A Naturalist's Perplexities—The VIPER—Its Habits and Use to Man—Its Food—A Plea for its Preservation—The RINGED SNAKE—Its Food and Mode of Life—Distinguishing Characteristics—Its Unpleasant Odour.

THE Reptiles of England are but few in number, and with one or two exceptions, are seldom seen in our gardens, preferring the forest, the heath, or the hedgerows for their habitation. All of them are carnivorous in their habits, and as such, cannot exert any evil influence on our gardens. If, however, the gardener should be able to capture any of the British reptiles (except, perhaps, the viper, though that is a very useful creature in its place), and possesses a garden surrounded with walls, he cannot do better than to give his captives a home in his garden, to build them hiding-places such as they best love, and to induce them, if possible, to bring up a young family in the safe seclusion of his little domains.

If my own garden were entirely walled, which I regret to say is not the case, I should certainly go off into the woods and over the heaths, bring home as many Blindworms, lizards, frogs, and toads as I could conveniently carry, and turn them loose in the garden.

The BLINDWORM is one of my especial *protégés*, and I have endeavoured for years to rescue it from the contempt and hatred with which it is so universally regarded, and to show it in its true colours. Perhaps it may be necessary to state that the Blindworm is not a snake, although it has so serpentine an aspect. The peculiar scaly surface is not that of a snake, neither does the flat, black, shallow-forked tongue belong to the snake tribe. It is in fact nothing more or less than a lizard without external limbs, and it is therefore obliged to wriggle itself along in serpentine fashion, just as a man would have to do if his hands were tied behind his back, his legs strapped together, and his feet reduced to a single point.

Many people entertain the greatest dread of the Blindworm. I find that even the viper, that really venomous and formidable reptile, does not inspire such fear as is entertained by many persons at mere sight of a Blindworm, simply because they know nothing about it, thereby proving the truth of the old adage, "Omne ignotum pro terribili."

They impute to the Blindworm qualities which even the cobra, the rattlesnake, or the puff adder do not possess, and which the combined powers of these deadly reptiles could not equal. It is thought to be saturated with venom, and to exude poison indiscriminately from every part of its body. According to their conceptions it bites the cattle, especially when they are lying down, and altogether it affords a notable instance of the strange errors into which men will fall, especially when there is an unfavourable opinion to be expressed.

In reality, the Blindworm is not only pacific as a dove and harmless as a butterfly, but it lacks the power of injury, even if it were viciously inclined. It has no fangs through which a poisonous secretion can be injected into a wound, and the teeth are so very minute that they cannot penetrate the human skin, and only serve to prevent the slimy prey on which it feeds from escaping after being captured. I have often put my finger into the mouth of the Blindworm, merely for the purpose of feeling the serried ranks of toothlets that edge the jaws.

The services rendered by the Blindworm to the gardener are almost equal to those which are paid by the thrush, without the single drawback of needing some recompense for its constant labours in our behalf. It is true that we do not see the reptile as often as the bird, and therefore we imagine that it is a rare species, and can exert but little influence upon our welfare. But if the Blindworm were as conspicuous as the thrush, if, instead of sliding stealthily and silently along the ground under the cover of darkness, and making its solitary repasts where the eye of man cannot witness its proceedings, it were to flutter from tree to tree with the strong wing of the thrush, strike up as mellow a song, and as openly consume its food, we should long ago have learned the real value of this useful and elegant lizard.

The Blindworm wages by night a war against the slugs in no way inferior to that which the thrush carries on against the snails, only it leaves no traces of its achievements, no broken shells or shattered trophies of a successful campaign. Gliding as silently as the creatures on which it feeds, the Blindworm follows the slugs as they traverse the herbage, and with the quietest and most deliberate air in the world, picks them off the leaves which they are devouring.

The creature is said to eat beetles, insects of various kinds, earthworms and similar beings. Whatever it may do in captivity, where it has no choice of food, I cannot say, never having reduced the reptile to such straits. But I have always found, and that after considerable experience, that as long as a slug is within reach, the Blindworm will touch no other kind of food. Even its tiny young, barely thicker than a knitting-needle, and hardly the length of a finger, will glide after a slug of double their size, and endeavour with laudable but futile perseverance; to swallow the enormous morsel.

Even these little ones have their appointed task. If the reader will take the trouble to inspect the garden at night by the aid of a good bull's-eye lantern, he will find the grass covered with very little slugs, scarcely larger than No. 1 shot, which he will not see at any other part of the day, and which would probably escape observation altogether, were not their pale forms brought out in strong relief by the concentrated glare of the lantern. These little creatures are too small for the adult Blindworm to trouble itself about, but they are just the size to suit the young, and it is most curious to watch the pretty little baby Blindworms ape the airs of their mother, and chase, catch, and eat the little slugs with exactly the same gestures as are employed by the parent.

The Blindworm is especially useful, inasmuch as it does not gorge itself, like the snakes, at a single repast, and then remain in stolid apathy for several weeks, while its meal is slowly digesting. On the contrary, it is mostly ready for food, and will eat almost daily. It certainly possesses the power of enduring a very protracted fast, but its capability of digestion seems to be inferior to that of the snake, probably because the soft substance of the slug requires less exertion of the digestive organs.

Like many other creatures, the Blindworm is a hibernator, seeking its dark concealment as soon as the early frosts give signal of approaching winter. This instinct is necessary for its welfare, because the slugs on which it feeds are very chilly beings, and have a great objection to making their appearance above ground when the earth is frozen, or hidden beneath a white mantle of snow. But, as if to compensate for this early retirement, the Blindworm is one of the first reptiles to leave its winter quarters, and show itself among the still stark and barren underwood. Indeed, it follows the destructive mollusc on which it feeds, and wherever the slug can be seen in the fields or gardens, it affords a sign that the Blindworm is yet at large.

It often comes out of its hiding-place when a warmer day than usual has thawed the frozen ground, and the slanting sunbeams have lost none of their feeble powers by the sharp winds. My own specimens used to be very capricious in this respect, lying quite motionless for days together, unless I placed the glass case in which they lay nearer to the fire, when they would begin to stir, and soon would push their way out of their simple tunnels. Even the slight increase of temperature caused by breathing upon the glass had the effect of arousing from their torpor those individuals which happened to be lying against it, though they would speedily recoil their folds, and sink again into their death-like slumber.

A detailed account of the habits of some Blindworms which were kept in a glass case for several months, may be found in the third volume of my "Illustrated Natural History," pp. 63—65.

SCALY LIZARD.—*Zootoca vivipara.*

ENGLAND is not very rich in the reptile tribes, possessing only a very few species of lizards and serpents. Of the true LIZARDS only two species are satisfactorily proved to belong to our country, both of which will receive a brief notice, as is their right.

The Scaly Lizard is one of the most active little creatures of which our fauna can boast, particularly when the sun shines brightly and his meridian rays waken the insect tribes into the fulness of their joyous existence. The eye can scarcely follow the brilliant little being as it darts hither and thither in chase of the active insects that flit among the grass blades, now remaining motionless as if carved out of stone, and now leaping forwards as if impelled by a spring or shot out of a gun.

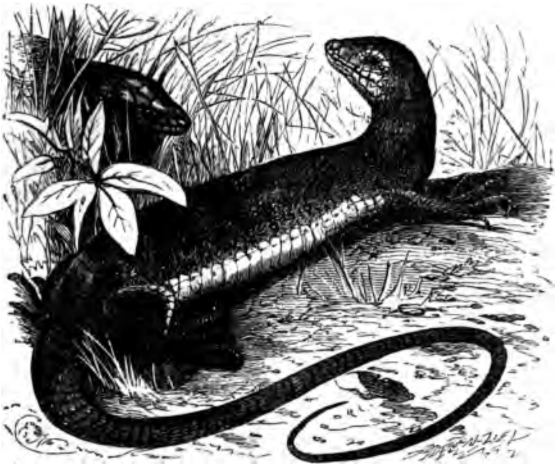
This extreme rapidity of movement renders the Lizard very difficulty to capture, especially as it is fond of frequenting gorse-covered heaths and commons, and darts in and out of the prickly shrubs with such constant agility that it is no easy matter to secure it without pricking the fingers. A glove cannot be worn when the capture of a living Scaly Lizard is contemplated, for the little creature is so delicately formed that the rough contact of a gloved hand would in all probability injure it in no slight degree.

I rank the Scaly Lizard among our garden friends because it is such a pertinacious destroyer of insects, and I feel no doubt but that it might be encouraged in a garden with excellent effect. The only precaution needful would be to give the little creature a locality resembling as nearly as possible that which it frequents in its free and wild condition.

It is of course necessary that the garden should be surrounded by a wall, as the Lizard would soon make its escape under any other circumstances. Certainly, a wet ditch might answer the same purpose, for I do not think that the Scaly Lizard ever takes voluntarily to the water, though it can swim rapidly enough if thrown into that element.

Although the specific name of *agilis*, or active, has been given to the Sand Lizard, it is hardly as appropriate as if it had been bestowed upon the preceding species. For, although the Sand Lizard is without doubt an active little being, it wants the restless agility of the Scaly Lizard, and does not flash about after the manner of that species.

The experiment of keeping this Lizard in a walled garden has not, as far as I know, been tried. In general, it is very impatient of captivity, at all events when placed in a fern-case or a dwelling such as is employed successfully with the scaly lizard and other reptiles. It is at times apt to be morose in disposition, and, if captured, does its little best to bite the hand that is laid upon it. There is a certain dash about its attack which would in all probability startle those who did not know that the Lizard is perfectly innocuous, and, like many other beings, it often may escape from a more powerful foe by masking its real weakness under a temporary guise of assumed ferocity.



SAND LIZARD.—*Lacerta agilis.*

When placed in a cage, the Sand Lizard appears to be as depressed as a gipsy in a prison, and as much out of its element. A sort of *mal du pays* seizes upon the little creature, it retreats to the darkest nook that it can find, broods moodily in sullen stillness, refuses to eat, pines visibly from day to day, and before very long is found lying dead in its corner.

Whether any of my readers have been more successful in keeping this little reptile I cannot say, but hope that if they have managed to preserve a Sand Lizard in health for a month or two, they will kindly communicate with me.

Perhaps I may be excused for taking the present opportunity of mentioning that I shall always be greatly obliged if any reader who has observed facts in Natural History will be good enough to forward to me some account of them, no matter how trivial they may appear to be. The history of a tamed animal, whether bird, beast, or reptile, is always valuable, as is also an account of the habits of every living creature. Much light is often thrown upon obscure and vexed questions in Natural History by an apparently unimportant action performed by the creature under discussion, just as in comparative anatomy the ascertained presence or absence of some minute particular, perhaps too small for the unaided eye to observe, will settle a question which has been under debate for many years.

The usual fate of an imprisoned Sand Lizard is much as I have just described, but it would be an interesting experiment to try whether the pretty little being could be kept in health if placed in a garden whence there was no escape. Every advantage ought to be offered to the Lizard, and its semi-prison be made to bear a close resemblance to the spot on which it was taken. A sand bank should be thrown up, having a southern aspect, and upon its top should be laid plenty of turf and heather cut from the place on or near which it had formerly lived.

Such banks will thrive well, if care be taken to cut deeply into the soil round each heather plant, so as to carry away a large ball of the peculiar earth that is found on commons. I have successfully transplanted a large quantity of gorse bushes to my own garden, by employing similar precautions; and, while I write, their brilliant yellow blossoms are in full vigour, and in every stage of progress—some with their glowing petals fully spread, and others just showing their downy points among the prickly leaves.

A little bit of uncultivated nature has a very good effect in a garden. One of my friends, who built his own house, and laid out his own grounds, has introduced a charming episode—if we may use the word—in his garden. One portion of the ground—a rough and broken hill, scratched into holes by rabbits, and excavated, in days long passed away, by the sand dealers—was allowed to remain in its natural state, and is masked by fir and other evergreens from the rest of the grounds. The consequence is, that, in walking about the garden, you come to a little path, and follow it, wondering where it may lead you. Suddenly, the path turns round a clump of fir-trees, and you find yourself apparently in the open country. The yellow gorse blooms abundantly above your head, the heather is under your feet, the eglantine and the blackberry cluster thickly in heavy masses, the bracken fern lifts its wide leaves on every side, and the wild flowers of the season bloom around. It was more beautiful than when it formed part of the waste land, because it has been left for a series of years quite undisturbed and uninjured by the tribes of mischievous boys who congregate in such places, and by the cattle which are turned out to feed and do much damage as they stumble among the bushes and crush the flowers under their careless feet.

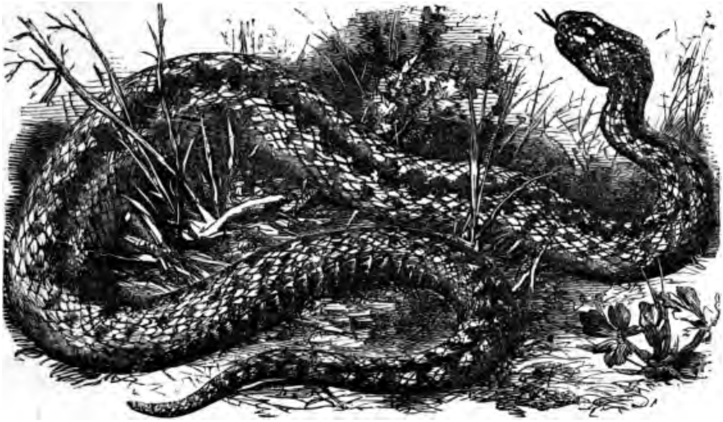
If a similar spot of ground could be surrounded with a tolerably high wall, and the doorway protected by an upright slate slab over which a man can step, but which a mouse or lizard cannot climb, an admirable opportunity would be afforded for studying the habits of many a creature that could either be enclosed at the time when the wall was built, or transported from the exterior world. It would then be possible to sit for hours together, watching the various beings that find a home amid these wild plants, without the many drawbacks that attend a naturalist when attempting to pursue his pleasant occupation in the open country.

Every one who has endeavoured to trace the habits of living creatures in their wild state has experienced the extreme annoyance which is caused by human curiosity. Just exactly at the very time when absolute silence is required—when even the breath is held under command, lest the delicate senses of the wild animals should be startled by the sound—a heavy-booted rustic will come clumping along, and ask, in a voice that might be heard across a field, what you be a-looking at; or a host of boys assemble round you, and volunteer all kinds of conjectures as to your occupation; or a troop of children discover you, and shout to each other to come and look at a gentleman sitting in the spinney; or a dog discovers you, and, taking you for an intruder, yells at you with mingled anger and fear.

Sometimes you are taken for a spy, sometimes for a poacher, and sometimes for a trespasser. For my own part, I have been captured by policemen, chased by gamekeepers, and threatened by farmers. I have been obliged to dodge perpetually round tree trunks, to lie in dry ditches full of nettles, and to crouch under bramble bushes full of thorns. I have been made the butt of much rustic wit, and the scorn of village school-children. I have been feared as a wizard and derided as a maniac, and generally found that either reputation is rather valuable than otherwise; as, in the one case, every one keeps aloof, and, in the other, you are allowed to act as you please.

Not without reason, therefore, do I recommend that the naturalist should find some mode of conducting his researches in peace and quietness; for in no other manner can he hope to watch the proceedings of animated beings with any likelihood of success.

To return to the Sand Lizard, which has led to this digression. In its general habits it resembles the Scaly Lizard, and, like that reptile, is a great destroyer of insects, catching them after a similar manner, and feeding freely upon them. In one point, however, it differs greatly. The Scaly Lizard produces its young in a living state, while the Sand Lizard lays eggs in the sand, covers them over, and then leaves them to be hatched by the warm sunbeams. It is somewhat similar in general appearance to that species, but may be known by the green hue upon the sides. It is always variable in colour, sometimes being speckled with black, and banded with brown; but the green mark upon the sides will serve as a mark by which it may be distinguished. In some specimens this colour is very decided, but in general it is rather faint and not pure.



VIPER.—*Pelias Berus.*

Perhaps my readers may feel some little surprise at seeing the **Viper** among the Garden Friends and Foes, and even more astonishment at finding it classed among the former.

Although it is very seldom seen in our gardens, it has a right to be ranked among our friends, because its food consists mostly of animals that are injurious to the garden.

Shunning, as a general fact, the neighbourhood of man, and remaining hidden in the forest, on the heath, or the hayfield, the Viper can do no personal harm to the gardener, so that its envenomed fangs cannot be adduced as a reason why it should be placed among our foes. The Viper dislikes man, as it has good cause to do; and any one who is bitten by one of these reptiles has only himself to thank for the injury, paying the penalty of intruding upon its legitimate domains, without having taken the precaution of shielding himself against the assault which it may possibly make.

Only under great provocation will the Viper bite. If you tread upon its tail, as it glides over the ground, or if you chase it into some corner where it is driven into bay, it will instinctively use the terrible weapons with which nature has armed it. Otherwise, it avoids the contact of man, and slides off as soon as it hears his approaching footsteps. I have walked for days in one of the noted viper-haunted districts of the New Forest, and never even been struck at by the reptiles, though I have seen them crawling along almost under my feet. Only once did I see a Viper strike at anything which approached, and in that case the back of the creature was severely injured, so that it could not crawl away, and could only lift the forepart of its body in a menacing attitude.

Gardeners have therefore no reason to complain of the Viper, as far as themselves and their gardens are concerned, but have rather a good reason to thank it for destroying the very creatures which they rightly detest.

The Viper feeds on various animals, and even on birds, but is particularly fond of the field-mice, whose destructive powers have already been mentioned. Quietly and stealthily as the mouse may glide through the herbage, it cannot escape the quick eye and lightning-like dart of the Viper, which will sometimes strike it as it passes unheedingly by the spot where its destroyer lies concealed, or sometimes will pursue it through the grass and hunt it down.

I fear that the inherent instinct of destructiveness which is latent in human nature is particularly excited by the presence of serpents, and that very few can see a snake without feeling an irresistible desire to kill it. Still, it will be better and wiser to check this instinct and allow the Viper to go free. To kill a Viper is thought by many persons a most praiseworthy action—the same persons believe that the slaughter of a rook, a weasel, or a toad, is also an act deserving of praise—and, as is well known, there are men who get the greater part of their living by catching these reptiles. Yet it seems to me to be very clear that, however obnoxious the sight of a Viper may be, and however its presence may excite an organ of destructiveness, we ought to spare and protect it, as long as it confines itself to its legitimate domains, and does not intrude upon the cultivated grounds of civilized man.

I should not like to keep a Viper in my garden, because it would be out of its place, and its services in mouse-killing would certainly not compensate the disadvantage of its poison fangs; but, at the same time, I would not kill it if I were to see it in a field, unless I wanted the body for some purpose, or were in absolute danger of being bitten.

There is no difficulty in distinguishing a Viper from the common ringed snake, as the line of black zigzag marks that runs along the spine is a characteristic that serves to proclaim its identity at the slightest glance. The colour of the Viper matters little, as it is a very variable reptile in this respect. Mostly it is grey, with an olive tinge; but it is often yellow, sometimes nearly white, sometimes dull red, and now and then a variety is seen which is nearly black. In all varieties, however, the dark marks hold their place along the back.

RINGED SNAKE.—*Tropidonotus natrix.*

I HARDLY know whether to rank the RINGED SNAKE, or GRASS SNAKE, as it is sometimes called, under the banner of our friends or foes. It certainly cannot do any direct injury to man, and in that point is perhaps scarcely entitled to rank among our foes.

But on the other hand, the question is, whether it destroys a sufficiency of noxious animals to be reckoned among our friends.

When it can get them, it feeds much on frogs, a fact which would tend to injure its character in our estimation, because the frogs are such very useful beings in the garden. But, in default of frogs, which cannot always be obtained in every place, it will feed on various insects; and I have heard, though I cannot vouch for the fact, that it will eat slugs after the manner of the blindworm. In captivity it will feed on beetles, cockroaches, mealworms, and similar creatures. It will also drink milk, and eat bread soaked in it.

Unlike the viper, which shuns the vicinity of man, the Ringed Snake seems to have little fear of him, but lives in the hedgerows, enters the gardens, and penetrates even to the glass frames and hothouses for the purpose of depositing its eggs. The gardener often finds in such places the string of eggs joined together like a set of large oval beads, soft, parchment-like, and white in colour. Dunghills are favourite localities for the eggs, the Snake knowing by some intuitive wisdom that the heat contained by the decaying substances will hatch her eggs while she is far from them.

The Ringed Snake is easily distinguished from the viper or the coronella (the third British example of the Snakes), by the bright band behind the head, a tinge of red sometimes giving to the yellow an orange tint. Another collar or band of deep black runs just behind the yellow.

Let me give just one caution to those who wish to catch a Ringed Snake, and have delicate olfactory organs. Seize the creature with a leather-gloved hand, and do not allow it to touch either your skin or your clothes, for it possesses the power of throwing out a most abominably offensive odour, which is distinguishable after a wonderful length of time, can scarcely be washed away even by repeated ablutions, and utterly refuses to be disguised under any perfumes. This odour is, however, only emitted when the Snake is very angry or very much alarmed, and after a day or two of captivity the creature seems to forget its noisome powers, and will allow itself to be handled without making itself disagreeable.

TOAD.—*Bufo vulgaris.*

CHAPTER V.

Frogs and their Kindred—The TOAD—Its Personal Appearance—Some Fables regarding the Toad—Books *versus* Experience—Terrors of an Unknown Danger—Characteristics of the Vulgar Mind—Traditions and their Moral—Children and Nursemaids—Natural History of the Ancients—Man and his Friends—The Word "Toad" used as an Epithet: its Right Meaning—The Services of the Toad—A Night Scene and the Actors—Activity and Perseverance of the Toad—How it strikes its Prey—Its Voracity—Domestication of the Toad—A Toad House—The NATTERJACK and its Characteristics—The FROG—Its Mode of Progress—A Plea for the Frog—The Law of Reciprocation—The Universal Family and its Members—Use of the Frog—The Plague of Frogs—Egypt and England—A Frog Colony and its Uses.

SEPARATED as are the Frogs and Toads from the true reptiles, we must here rank them together, for the sake of convenience, this little book not pretending to scientific arrangement or troubling itself about scientific details. It is true that Frogs and Toads are hatched into tadpoles, with gills, and that the tadpoles change in good time into Frogs and Toads with lungs. But, in the structure of the adult animal they bear so great a resemblance to the reptiles that they may be ranked among them in the present volume.

Not even the most enthusiastic admirer of the Toad dares say that it is pretty, or that it is graceful, or that it is popularly interesting. In truth, it is about as ugly a creature as is found in the British Islands, having nothing beautiful about it except its eyes, which are too expressionless for real beauty, though they ever gleam with an inward light, which is not quenched even by death, and, from their carbuncle-like radiance, have given origin to the once credited fable of the jewel in the head.

Scarcely less fabulous are the tales which are so widely believed respecting its venomous properties, and which are, strangely enough, principally circulated by those who are continually in the habit of seeing the animal. Your citizen, who has read his Natural History books, will take up a Toad without any concern, though he may never have seen one before, and in spite of the earnest advice to let it alone which is sure to be liberally showered upon him. He knows that it *cannot* be venomous, and feels as secure upon the subject as he would be if any one tried to persuade him that a horned and hoofed animal was predacious like the lion, or could climb trees like the monkey.

But your rustic, who has little acquaintance with the book-learning that is so contemned by a certain set of critics, and the unlimited practical experience which is so belauded by the same personages, will as soon thrust his bare hand into a glowing fire as take up a Toad with it.

Perhaps he would perform the former operation rather than the latter, as in the one case he knows exactly the peril which he faces, while in the other his very soul is filled with terrors, all the more potent because they are undefined.

Similarly, the man who will face a battery without the least hesitation, and rush upon almost certain death without the colour fading from his cheek, or his pulse changing its healthful cadence, will be overcome by imaginary terrors in passing alone though a churchyard by night; and if he should perchance see a faint gleam of white reflected from a fragment of linen, or an old shattered newspaper careering through the air, his knees knock together with fear, his skin creeps, a cold perspiration bedews his brow, and he suffers unutterable agonies of fright, thinking that he has seen a ghost. No terrors are so fearful as those which have their rise in the imagination.

We receive most of these erroneous impressions in our childhood. Servants are generally well stored with tales of dread, the class to which they belong having a strange liking for horrors, a morbid affection for the terrible and the repulsive, rather than a pure love for the gentle and the beautiful.

Under such auspices dogs present themselves to our childish minds as barking and biting machines, always mad, and causing those whom they bite to be smothered between the bedclothes by order of the doctors—an ingenious touch of art, because we get the doctors into our chamber of horrors as well as the dogs. Cows are only made to gore us, horses to kick us, bees to sting us, birds to peck our eyes out, newts to spit fire at us, earwigs to crawl into our brains, cats to suck our breath while we are asleep in our beds, worms to eat us after we are dead, owls to tell us that we shall die before the year is out, and there is always a bogy in the cupboard, in order to insure the fulfilment of that prediction.

In their morbid minds, almost every being that crawls, or walks, or swims, or flies, presents some image of terror, something to be avoided, something to be disgusted at, something to hate, something to fear. They walk amid terrors through life, they shut their eyes to the beauty around them, and they fill this lovely world with loveless images. Reversing the Divine fiat that everything was very good, they put forward a new edict of their own, and pronounce everything to be very bad; and if all that they say were true, man would no more bear dominion over the earth, but would be the cowering vassal of almost every being with which he comes in contact.

This is a wider question than it seems to be, and bears a deeper significance than appears on the surface.

We can but know the Creator through His works, and even in the pages of Revelation our instruction is given by images. Our highest teaching is imparted by parables; the beast of the earth, the bird of the air, and fishes of the sea; the flowers of the garden, the fruit of the tree, and the grass of the field having all been displayed to us as mirrors in which the love of the Almighty is ever glassed. It follows, therefore, that if we read the works of God wrongly, we cannot learn to look upon Him rightly, and that as long as we can see nothing in His works around us but images of fear and pain and disgust, we shall never learn the true nature of our God, who has clothed the earth with emanations of His beauty, and poured upon it the stores of His goodness, and filled it with His eternal presence, and dowered it full richly with the treasures of His love.

To those whose ears are open, there is not a mote dancing in the sunbeams which does not hymn its eloquent though silent praises, not a dust-grain on the road side that does not echo the mythic anthems of the spheres. The humblest herb that we tread under foot bears on its tiny leaves many a lofty parable, though the interpreter may not yet have appeared; and even in the humming of insect wings, in the sweet perfumes of the opening blossoms, and in the soft tints of the glowing petals, lie hidden the mightiest mysteries of creation, unexplained though not unsuspected.

Little of this spirit do we see in those to whom we are obliged to transfer much of the care of our children. Rather do we find them constantly endeavouring to instil their creed of terror into the receptive minds of the young children under their charge, ideas which can never be wholly eradicated, which saturate the whole being, and which even the light of reason and knowledge can but moderate for the time. A man knows that the notions which he has received are false, he can refute them by irrefragable arguments, he can laugh at them in conversation, and yet, there will ever and anon come an hour when they will reassert the dominion, and, as was said of a similar subject, though he denies them with his lips he confesses them with his fears.

When we see so many really graceful and lovely creatures libelled in so gross a manner, we could hardly expect that an ugly and awkward being like the Toad would escape a similar fate. Perhaps there is no creature that has suffered more contumely than the Toad, or deserved it less. Strange and wild are the stories told of its venomous powers, wilder than any fairy tale, and full of incidents which display the inventive powers, if not the veracity of the historian.

Some of the very old books on Natural History are as amusing to read as "Gulliver's Travels," or "Robinson Crusoe," having, moreover, this advantage, that the writers did honestly believe every word they wrote. What wonderful stories do they not narrate of the Toad. No royal prince ever had more lies told about him than are showered with prodigal profusion around the head of this devoted animal. The Toad among animals was, according to these books, the analogue of the Upas tree among vegetables, or, if possible, was even more to be dreaded, because the Upas, being a tree, was obliged to stand still in one place, whereas the Toad could move about and scatter death and disease in its path.

If it sat under the roots of a tree, and you happened to pluck a leaf and rub it against your teeth, you straightway turned black, swelled up, and fell dead. If you wished to get rid of an enemy, you might do so by asking him to your house in the autumn, after rubbing a Toad against the finest fruit. Suspecting nothing, he would pluck the fruit, eat it, and die on the spot. Nay, according to the "Physitians," a dried Toad would stop bleeding at the nose, because "horrour and fear constrained the bloud to run into his proper place, through fear of a Beast so contrary to humane nature."

These old, old stories, enlarged to suit modern capacities, embellished with sundry improvements and having lost nothing in the telling, have been handed down to us from remote generations, and are still firmly believed in many parts of the country. Thus, we find even at the present day that the belief in the venomous powers of the Toad is rather stronger than in those of the viper, and I am perfectly certain that the generality of rustics would rather seize a viper with the bare hand than a Toad or a newt.

It is an old saying and a very true one, that man never knows his best friends; and certainly this maxim holds good with regard to the Toad. We use its name as a term of opprobrium, and in many of the provinces there are few stronger modes of applying objurgation than to call the delinquent a "twoad," a word which seems to be about equivalent to the mysterious epithet of "wusbird," or "osbird," which is so liberally applied in Wiltshire and its neighbourhood.

Yet, if applied rightly, the word Toad ought to be a title of honour. It ought to imply that the individual was of sterling worth, though his exterior might not be prepossessing. It ought to be held as likening him to Socrates, Æsop, and other hard-favoured personages, who were not engaging to the eye, but of infinite value to the community. It ought to imply that while the generality of mankind slept, the individual who is honoured with the title of Toad was watching and working silently for their welfare. It ought to mean that we no longer trust to outward appearances, but that we measure a man by his deeds and not by his dress or his rank, or his wealth or his professions. It ought to show that we are beginning to read nature rightly and to be the heralds of a new era for the human race.

It is but scurvy treatment that the Toad meets at our hands, his services being neglected and his person despised. Let me hope that every reader of this little book will learn a truer appreciation, and endeavour to place the Toad in the position to which he is entitled. Should any of your acquaintances persist in killing one of these creatures, let its death be the means of saving the life of many a relative. Take out your penknife, open the stomach, and show the murderer its contents, and make him lament the cruel and foolish act of which he has been guilty. It will be with the reptile as with man,—

"We slight him till our patronage is vain,
Then round his skeleton a garland weave,
And o'er his bones an empty requiem breathe."

If the Toad were a native of a foreign land, and were imported at a high price, we should have held him in great respect. But he has little honour in his own country, as is the general fate of those that work for the benefit of mankind, and shares equally their labours and their neglect.

What, then, are the services rendered to mankind by the Toad? They are these. At night, when the shades of evening have fallen upon the earth, the destructive insects lead their armies from the dark ambushes in which they have lain hidden during the day. From every inch of earth arise the varied forms, springing up on every side like the armed men from the dragon's teeth.

On a fine summer's evening, take a lantern, and watch a few square yards of ground carefully, and you will see a sight. The slugs come gliding silently out of the dark soil, without a particle of earth clinging to their slimy surfaces. Guided by instinct they proceed to their evening banquet, from which they do not rest until the dawn appears in the eastern sky.

Hosts of snails move up to the attack, various tribes of caterpillars and grubs show themselves boldly, and before an hour has passed away the apparently deserted herbage is covered with its many plunderers. On these the Toad wages a ceaseless warfare. Ranging slowly at night over the ground, he lets little escape him wherein is life and movement. Dull, slow, and heavy as he seems, he can catch some of the wariest and swiftest insects. Let a large moth, for example, settle on a leaf or shrub, and if it is within a moderate distance of the ground the Toad is sure to have it. With hasty but cautious steps he traverses the space between himself and his intended victim, raises himself on his hinder feet, looks intently at the moth, seems to take aim for a moment, and then with a sudden spring the insect seems to leap into his mouth. A few powerful gulps, and the moth has vanished.

No one who has not watched a Toad while taking its prey can form the least conception of the wonderful skill displayed, nor of the astonishing distance at which it can strike an insect. It does not even care whether its intended prey be in front of it, but will flash out its tongue to either side with perfect certainty; and I have often seen it flip its tongue under its body and secure a beetle that was trying to crawl away unseen.

Scarcely any insect is too small, and very few are too large, to escape the ready tongue of the Toad. It will catch and eat the tiny hoppers (*Halticæ*) as they crawl and skip about the leaves, while it will snap up even the great ground beetles with bodies nearly an inch long, with teeth that will meet in the flesh of a man's finger, and with limbs so powerful that they are difficult to be held in an ungloved hand. The long, radiating hairs of that caterpillar-porcupine known popularly as the woolly bear, and scientifically as the larva of *Arctia caja, alias* the tiger-moth, are of no avail to save the owner from entombment in the hungry maw of the Toad; and worms, grubs, slugs, and all kinds of creatures find a last home in the same accommodating receptacle.

It is rather remarkable that the Toad will not touch his prey unless it moves. He will sit and watch an insect with weariless patience, but will refuse to strike at it until it stirs, when out flashes his red tongue, and in a moment the insect has vanished. The appetite of the Toad is enormous, and it will continue to eat insect after insect with insatiable voracity. Caterpillars, slugs, beetles, moths, flies, earthworms, cockroaches, spiders, and many other creatures will be swallowed in rapid succession, without seeming to discompose the Toad in the least.

Like the beings on which it feeds, the Toad mostly keeps itself hidden during the daytime, and therefore is not seen so frequently as the more active and more conspicuous frog. It is, however, very plentiful, and those who know its habits can mostly find a Toad whenever they desire to do so, merely by going to the spots which Toads most like to frequent.

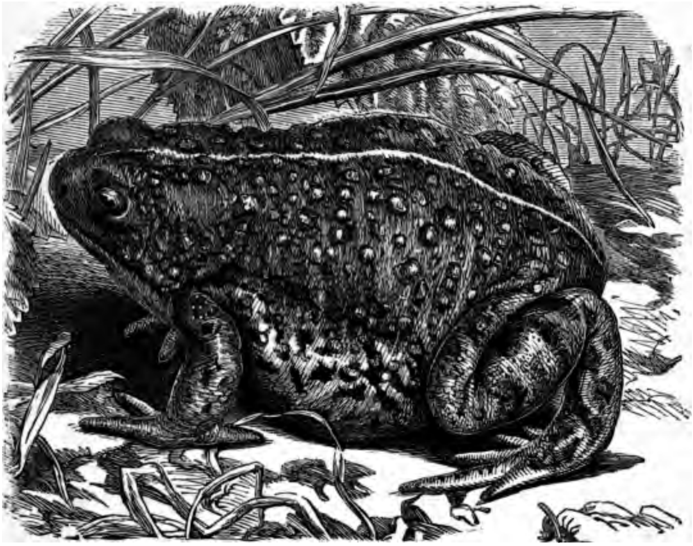
Let me, in the strongest terms, advise all my garden-owning readers not only to cherish and protect the Toad, but to give it a home in the garden and greenhouse. Nothing is simpler than a Toad's house. A bank of earth with a few holes bored deeply into it will be just the kind of place that a Toad likes, and any one who cares to make one will find his exertions repaid by introducing a small colony of these useful creatures into the garden. They will mostly remain in their dark homes during the daytime, unless the weather should be wet and lowering, in which case they either sally abroad, or come and sit at the entrance of their burrow.

Even if you give the Toad a bank of soft earth, he will dig a burrow for himself in a wonderfully short time, the apparently soft and tender feet being admirable spades, and aided by the tip of the tail—if the extremity of the vertebra may be called by that name. While engaged in making its burrow, the Toad works continually backwards, keeping its head towards the entrance of the hole and employing both pairs of limbs in the work. The loose earth is forcibly pushed out in front, and the creature wriggles itself into the ground with a movement that has a very ludicrous but at the same time a very powerful effect.

The Toad is easily tamed, and soon learns to come to its master when called. One of my own Toads, which at first used to be horribly frightened whenever I put my hand into the glass-case, and would retreat hastily to the furthest corner, soon learned that the dreaded object was only introduced for the purpose of bringing food, and in a very short time the creature would scramble hastily towards my hand as soon as it was put into the case.

Many professional gardeners are in the habit of purchasing Toads, and keeping them for the express purpose of ridding themselves of the noxious insects which destroy the vegetables, and on which the Toad loves to feed. The amateur gardener may, therefore, be sure that he cannot do wrong in imitating the example of his professional brethren, more especially if he procures at no cost, except a little personal trouble, the creatures which are handsomely paid for by others. Even in the house, the Toad has its uses; and if the servants can only be persuaded to let it alone, it will save them much annoyance, by eating the cockroaches—those noisome insects which are popularly known by the title of "black beetles."

At all events, I trust that the brief sketch here given will be sufficient to warn the reader against killing a Toad, or allowing others to do so; and even if, in spite of these pages, he cannot summon up a sufficient amount of courage to enable him to handle a Toad as unconcernedly as a kitten, he may, at all events, exercise the great privilege of humanity, and extend his mercy to the ugly, sprawling, awkward, but most useful being which we know so well under the title of Toad.



NATTERJACK.

I may as well mention in this place, that there are two kinds of Toad in England, the one being the creature of which we have just written, and the other being the NATTERJACK (*Bufo calamita*). In habits it is very similar to the common species, from which it may be readily distinguished by the much shorter hinder legs, with their black bands, the smaller webs on the feet, and the yellow line along the middle of the back.

This Toad is rather local, and is not so dependent on water as the last-mentioned species, remaining in the higher and drier situations, and seldom approaching the water, except during the breeding season, when it needs to lay its eggs in the congenial moisture.

FROG.—*Rana temporaria.*

OUR common FROG is scarcely less useful than the toad, and, as it is altogether a more elegant and agile animal, is not held in such detestation as that creature.

The very gestures of the toad while walking are of a forbidding character. It crawls slowly and awkwardly along, staggering as if wounded, and now and then making little futile attempts at a jump. But the Frog leaps merrily along, clearing wonderful distances at each spring, and displaying an amount of lively activity which contrasts favourably with the staid and sober demeanour of the toad.

The food of the Frog consists of insects of various kinds, slugs, millipedes, and other beings that injure our gardens. To us, therefore, as gardeners and agriculturists, the Frog is of signal service, and ought to be encouraged by us in every way; yet there are few animals which suffer more actual persecution than the Frog—a fact as old as Æsop, and probably much older.

Boys, with the thoughtless gaiety of youth, will persist in considering the Frog as a living toy. It can jump about well, it can swim well, and cannot retaliate upon its tormentors. Some of them are maliciously and deliberately cruel, inventing new torments with a perverted ingenuity that would have qualified them for the highest posts in the Inquisition. I should like to see the *lex talionis* brought to bear upon them as far as could be done without injury to their health; and I would here just remark, that the great law of reciprocation is eternal and unchangeable, and, though slow in its steps, is certain in its grasp. That which we sow we shall reap, and with goodly interest, not by any arbitrary judgment, but by the immutable conditions of our being.

The old Mosaic law of literal retribution, an eye for an eye, a tooth for a tooth, was not a mere stern, ruthless regulation fitted for the rebellious race for whom it was enacted; but, like the various provisions of that legislation of which it formed a part—like the daily sacrifice, the offerings for sin, the burning incense, and the frequent washings—it was intended as an outward symbol of an internal and spiritual condition of humanity, that could not have been understood without the mediumship of some such external sign.

Without going much further into this subject, which I reserve for a separate work, I will merely point out the key to this problem.

All created things proceed from God, and are emanations of Himself—living, moving, and having their being in Him—and consequently are linked together, and form part of one family by the mere fact of their existence. More than that, as we may gather from the words of the Apostle, we all form parts of one body, and though apparently dissimilar in aspect, character, and structure, are as intimately bound into one body as the hairs that overshadow the head, the bones that give strength to the system, the blood that pulses through the veins, and the heart that untiringly pursues its ceaseless task.

We must not think that the various kingdoms and classes into which we divide the visible creation are in fact so many separate and distinct groups of beings, unconnected with each other, and running their course independently of each other. On the contrary, though a pebble, a violet, and a lion may be as dissimilar in aspect and in position as a hair, a bone, or a drop of blood, each has its appointed place in the one great body, and but for holding that place could not exist at all. So it follows that we cannot injure one part of the universal body without inflicting injury on the whole, of which we ourselves form a part, just as if one member of our own body is in pain, the whole becomes a partaker of, and sympathiser with, the suffering.

We may advance still one more step. As all created beings are emanations from the Divine nature, the services which we render to them are rendered to their Creator, and the injuries which we inflict on them are inflicted on Him. We have already been told, on the very highest authority, that our kindness, our neglect, or, it may be, our cruelty to our fellow-men, are not restricted to them only, but affect the common Lord of all mankind; and we only need follow the argument to its logical conclusion, to find that it does not stop short at man, but embraces the whole creation of which he is the visible crown, made in the image and after the likeness of the Creator.

As fellow-creatures with ourselves, the Frogs have a claim upon our mercy, and a right to our consideration; but, as true though humble benefactors to the human race, they have a double title to our protection. We little know the benefits conferred upon us by the armies of Frogs which range the fields and the pastures, and occasionally make their way into the gardens, or we should long ago have covered them with the shield of legal authority, just as the adjutant and the vulture are protected in the hotter parts of the world.

The plague of Frogs that drove Egypt to despair is not one that would injure this country. We have no superstitious ideas about the pollution of their presence; they could not break the staff of our bread, inasmuch as we do not dig our ovens in the ground, and the Frogs would—if they had the least smattering of sense—keep far aloof from the bakers and their oven-houses. On the contrary, if a similar plague were to be inflicted on this country, it would be by the abolition of the Frogs, and not by their increase. Let only the ranal armies be held in abeyance for a single season, and the hosts of noxious insects, unchecked by their presence, would overrun the land, damage the crops of the present year, and deposit their myriad eggs in safety, each the promise of a future brood.

Not in these days are our Frogs as big as calves, as they were in the strange times of an era long passed away—neither were they of such gigantic dimensions in the days of civilized Egypt, in spite of certain imaginative artists. They are exactly of the size that is needed, no larger and no smaller—large enough to attack and destroy the largest and most powerful of our insect foes, and small enough to be unobtrusive and innocuous.

Let me recommend the far-seeing owner of a garden to set up a little Frog colony in his domains. It is easily done, for the Frog does not require even so much accommodation as the toad. A dark cavern, with a heap of loose stones, broken flowerpots, old turves, and similar substances, will make a home that the Frog will take a delight in; and it will be also as well, if the garden be an extensive one, to erect small wayside houses as it were, for the creatures to retire to whenever they please. The easiest plan is to dig a sloping trench in the ground, lay slates, boards, or tiles, over it, and cover it with earth, except a small opening at the upper end. The Frogs are very fond of these simple domiciles, and you may at any time find them merely by lifting up the tiles. When I was a child, we had quite a colony of Frogs in our garden, and used to make all kinds of houses for them. We covered them with inverted flowerpots, we built square brick palaces for them, with several stories and a tower, each of which was tenanted by a Frog. But of all inventions, none seemed to be so grateful to the Frogs as the simple plan which we have just mentioned.

In dry and hot weather, the frog-houses should be watered as regularly as the plants, for water is a necessity of the Frog's life. It imbibes water through its skin, and exudes it as rapidly, drying up into a stiff, horn-like mass when exposed for any length of time to the heat of the burning sun.

It will be also kind to the thirsty beings, if you keep a basin of water sunk in some shady spot, for therein the Frogs will revel, and therefrom they will start refreshed, ready for prey, instead of sitting moping in one spot, until the dews of night have afforded them sufficient moisture to support their existence. For it must be remembered that gardens, having so much bare earth, are not so bountifully supplied with water as are the fields, where every grass blade is thickly studded with heavy dewdrops, so that a Frog which would be plump and well-favoured in the fields might be nearly withered away by thirst in the garden.

It is, of course, impossible in the few pages that can be allotted to a single subject to give a complete account of the Frog, neither is it requisite for a work of this nature. I have intentionally restricted the history of the Frog to those particulars which have reference directly or indirectly to the garden, and have taken the opportunity of bringing its good qualities prominently forward, and showing, though in a brief and imperfect manner, the very great claims which it has to our indulgence and protection.

CHAPTER VI.

MOLLUSCS.

MOLLUSCS—The Species that influence our Crops—Their Localities—GASTEROPODA—Signification of the Name—Land Molluscs—SNAILS AND SLUGS—The Slug—Its General Habits—Its Food—Slug Traps—Various Remedies—Lime, its Advantages and Disadvantages—Anecdote of a Slug—Ammonia—Its Uses, and how to Manage it—Turning the Tables—The Horse-hair Rope—Slime, and its Uses to the Slug—Prolific Character of the Slug—Tenacity of Life—Sense of Pain—Reproduction of Parts—Various Species of Slug—The TESTACELLA—Its Use to the Gardener—The SNAIL—Its Teeth—The Edible Snail—Hibernation—The Cell and the Epiphragm—Senses of the Snail—Sight and Smell—Cupid's Darts—Mythology and Reality—Loves of the Snails—The Eggs of the Snail—Tenacity of Life—Anecdote of a Snail—Method of destroying Snails—General Observations.

AMONG the many members of this vast class of the MOLLUSCS, there are but few that exert any direct influence upon the lands which we cultivate and the crops which we raise.

In the British Islands the Molluscs maintain their countless hosts, all voracious, as is the wont of "armies, those all-consuming animals," as they have been graphically termed, and for the greater part feeding upon vegetable substances. In our seas they multiply exceedingly, and almost every scrap of seaweed that is thrown on the shore, and every branch of growing alga that fringes our coast, is either the resting-place of some mollusc, or bears marks of its voracity. Our rivers and ponds are filled with them, sometimes being almost choked with certain prolific species, but by far the greater number of species are inhabitants of the water, either marine or aquatic.

Only a few species of British Molluscs inhabit the land, and even these creatures belong but to two or three genera. These—with perhaps a single exception, and that an imported species—are among the deadliest enemies of our garden, and are popularly known under the title of Snails and Slugs.

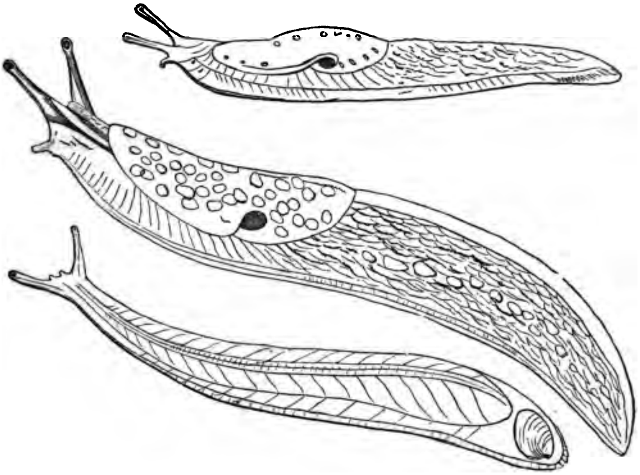
As, in order to encourage those beings that are beneficial to us, and to repel or destroy those which are injurious, it is necessary to possess some insight into their habits and structure, I shall take the present opportunity of mentioning those characteristics which are most valuable for either object. And as there is some good in everything that has been created, and some beauty even in those beings which are most personally repulsive to ourselves, I shall also point out some of the more interesting characteristics of these beings which are so deservedly detested by the gardener.

In the first place we may assure ourselves that no mollusc can do us any harm, unless it is one of the GASTEROPODA; *i.e.* unless it possesses a flat, foot-like mass of muscle on which it glides along. Therefore, the whole of those shells which possess two valves—such, for example, as the mussel and the oyster—must once be excluded from the ranks either of friends or foes, and need not be considered in the present volume. The word Gasteropoda signifies literally "belly-footed," and is sufficiently appropriate, as the long, flat, muscular foot runs along the under surface of the animal.

Perhaps this zoologic fact may have given rise to the queer human monstrosities that may be seen finely drawn in the *Nurenberg Chronicle*—men with only one leg and one foot, but that foot large enough for any of the gianthood. A most useful foot it was too, for the owner could hop along faster than our ordinary bipedal man could run; and if the heat of the sun were very oppressive, the contented monopod had nothing to do but to roll over on his back and hold up his foot as a parasol.

The land molluscs may be broadly divided into the shell-bearer and the naked molluscs, of which the latter will be considered first.

THERE is not a field, nor a garden, nor a backyard, nor hardly a flowerpot, where may not be found some of the SLUGS, those pests of the agriculturist. We know but little of their numbers or of their habits, because they are not only night-feeders, keeping themselves at home during the daytime, but they hide themselves in such dark crannies and sombre recesses, that they can seldom be discovered except by the keen sense and piercing eye of the blackbird, the thrush, or the starling.



GARDEN SLUGS.

Some of the Slugs, such, for example, as the great grey Slug, retire during the daytime into holes of trees, the recesses under heaped stones, or similar localities, while others of smaller dimensions burrow under the earth, and there remain secure during the hours of daylight and sunshine. A wet day, however, will mostly entice them to the surface, as they have a great dislike to crawling upon dry and dusty substances, and in the hot summer season seldom are seen abroad until the dews of evening have made their path easy.

The damage which they do is almost incalculable, the best and freshest herbage being selected by their dainty palates. Even in the earliest spring, the Slugs begin to assert their destructive powers, and if they get into garden frames work terrible damage among the plants. Young lettuces, for example, that spread their light green leaves so freshly and so crisply at midday, will, on the following morning, be reduced to a series of short stumps, eaten closely to the ground, the destroyers having banqueted during the night, and then retired below the earth, where they cannot be seen.

To check the depredations of these persevering foes is by no means an easy task, and all the vigilance of the gardener will be required, and all his ingenuity will be taxed, to enable him to keep these pests within moderate limits. Hand-picking is always an effectual though troublesome and expensive remedy, and has this further disadvantage, that it can only be pursued with any hope of success in the evening, or during a rainy day. A good lantern, and a sharp eye, and a back that is not easily tired by stooping, will make great havoc among the Slugs in the eventide, but their numbers are so very considerable that hardly a tithe can be seen, much less captured.

Traps are tolerably effectual and very simple, consisting merely of a heap of cabbage leaves, laid in some sheltered and retired place. Here the Slugs will assemble in numbers, and may be taken without difficulty. Thin slices of potato mixed with the cabbage leaves are also useful, and fresh brewer's grains are said to have a great effect in attracting these tiresome molluscs. They must chiefly be looked for beneath the leaves, as they prefer to remain as much as possible in the dark. As these creatures are somewhat carnivorous, not to say cannibals in their habits, it is advisable to kill a few of the Slugs and replace them on the heap. Next day they will be surrounded with their living relations, who have been observed to feed on their bodies with great eagerness.

Lime is strongly recommended as a poison for the Slugs, as well as a protection for the plant. For the latter purpose it is well adapted, as the sharp lime dust is peculiarly noxious to the

Slug, and the creature will not cross even a slight line of the white powder. But the lime has a very partial effect, and requires enormous care in the laying. It must be placed closely round the plant which is to be preserved, or otherwise the Slugs will rise out of the earth within the ring of lime dust, and feed on the plant without the least hindrance. It must not lie on the leaves, as it burns them, and changes their lively green to an unsightly yellow and brown.

Moreover, it is not so fatal to the Slugs as is generally thought. Having had some suspicions on the subject, I took some great grey slugs out of a hole to which they used to resort, put them on the ground, and poured a spadefull of lime over them. At the first touch of the lime they began to bubble and fizz as if they were being boiled, contracted themselves into rounded lumps, and seemed fairly to have succumbed under the caustic powder.

But, after a while, I saw the lime begin to move; near the edge of the heap a head with its tentacles protruded itself, and presently one of the Slugs quietly glided from under the lime. As it drew clear of the objectionable substance, it began to secrete slime in vast abundance, and threw off the whole of the adhering powder, together with the slime, crawling away as clean as when I took it out of its home. The only difference perceptible in the creature was, that it was much more slender than when it was first taken, probably on account of the enormous amount of slime which it threw off.

I have found that a most potent means of destruction is ammonia, which kills the Slugs, without damaging the vegetation on which they feed. I take some solid ammonia and dissolve it it water, so as to make a very weak solution, and when the shades of evening are beginning to fall, I water the ground carefully, taking care to give every inch of soil its dressing of ammoniated water.

The effect is rapid and certain. The Slugs that are yet in their subterranean dens come hastily to the surface, and there lie paralysed by the potent fluid. They cannot throw off the poisoned water as they did the powdered lime, and are sure to yield to their fate, becoming an unresisting prey. Moreover, one effect of the ammonia is to render their skins quite white, so that they are rendered more conspicuous by the fatal liquid.

If two persons work in concert, the Slug harvest which they will gather is really astonishing. As soon as a bed or a patch of turf has been dressed, the track of the watering-pot may be followed by the gatherer, who will find his prey lying motionless on the ground, or just struggling their way out of the ground with a last effort at escape. As soon as a small hand-vessel is filled with the dead and the dying molluscs, it should be emptied into a larger vessel in which is about a pint of the same solution. That is the way to "mak sicker," and it has this further advantage, that when the vessel has been allowed to remain for a day or so, its contents may be emptied on the leaf-heap, and will make a powerful and useful manure.

The ammonia not only exercises no injurious effect upon the herbage, but is absolutely beneficial to it, giving out some of the most valuable properties of stable-litter.

For trees that are trained against a wall, the lime is a tolerably effectual preservative. A tolerably thick layer should be strewed along the base of the wall, and as the Slugs are very apt to crawl over a wall in order to get at the trees on the opposite side, another layer should be sprinkled along the top. The lime must be renewed about once a week in calm weather, but in stormy seasons it requires constant care.

Soot, fine coal ashes, and sawdust, are also substances to which the Slugs have a great objection, because they adhere to the large, smooth surface of the foot, and prevent it from acting properly.

A new and rough horsehair line, such as is employed for hanging clothes upon, is also a good preservative to trees. If a piece of this line be fastened round the trunk of a standard tree, or nailed carefully along the lower part of a wall so as to embrace the stems of the trees trained against it, the Slugs will seldom pass over the obstruction, slight though it may be. The fact is, that the many projecting hairs act as a *chevaux-de-frise*, and the Slugs, finding that all their efforts at crossing it result in getting themselves pricked, yield the point, and cease their attempts.

The slime which the Slugs can secrete in such abundance, and with which we are only too familiar, by the shining tracks that show where these molluscs have passed, is a really curious substance, and discharges some remarkable offices.

As is evident at a cursory glance, one of its principal uses is to lubricate the surface of the body, to which it acts as a defence against obnoxious substances which might cling to the soft skin were it not guarded by some such provision, and another use is to render the objects over which it crawls sufficiently smooth for the wonderful muscles of the feet to act upon them. How perfectly it can fulfil the former of these objects has already been mentioned when relating the effect of lime upon the Slugs, and the manner in which it effects the latter purpose is patent to every one who has seen a snail or a Slug crawling over an uneven surface.

But it also has other offices, and in the case of the Slug is often put to a very remarkable use. Slugs may frequently be seen to lower themselves from a branch like the silk-spinning caterpillars, and it is not an uncommon sight to see these molluscs hanging by a thread, and slowly revolving in mid-air, as if they were enjoying a swing. Now, if these creatures be examined, it will be found that the rope which bears them is composed of the same slimy substance that so plentifully lubricates the body, and is sufficiently strong to uphold their weight.

The water-snails employ their slimy secretion for a similar purpose, and may often be observed ascending and descending through the water as if by simple volition, or as if they possessed the power of crawling through the water itself. On a close examination, however, it will be found that the creature is moving upon a slime-woven cord which it has attached to aquatic plants or other fixed objects, and which is invisible to the eye, because its refractive powers are so similar to those of the water in which it is immersed.

If the surface of a snail or a Slug be examined with a good pocket magnifier, it will be a very easy matter to detect the numerous pores through which the slimy secretion passes to the exterior, though dissection seems not as yet to have discovered the laboratories in which such enormous quantities of slime are formed. The whole exterior of the body is covered with deeply-furrowed channels communicating with each other, which serve as a means whereby the secretion shall be equally distributed over the body.

The Slug is a very prolific being, and were it not for the many enemies which surround it on every side and pursue it by day and by night, every green thing upon the face of the earth would be devoured.

Taking the average among the Slugs, each individual lays five hundred eggs in a season; and as the number of slugs even in a small garden is almost beyond calculation, it will be seen that the rate of increase must be enormous. These eggs are little round bodies, with a skin soft as parchment, and nearly as tough. The vitality of the eggs is almost incredible. You may squeeze them nearly flat, and they will survive. You may put them before a fire or in the hottest sunbeams, and dry them until they wither up to the tiniest points, scarcely visible without the aid of a microscope; yet, if you put them in a damp atmosphere, or pour water upon them, they immediately begin to resume their original form, rising as it were out of nothing, and in a short time becoming as round and as plump as ever.

You may subject them to a temperature of 120° Fahr. without killing them—a fact which may possibly not appear to be particularly remarkable to the frequenters of Turkish baths. Or you may freeze them as hard as hailstones, and the vital sparklet will yet burn unquenched. One experimenter actually dried and wetted some Slugs eggs eight successive times, and found that the young molluscs were hatched from these hardly-treated eggs, just as if they had been left undisturbed. Even when the little creature was partly formed within the egg, it resisted the successive desiccations and moistenings without injury.

Even in the perfect being the tenacity of life is wonderfully great. Some writers advise that when the Slugs have become attached to the substances used to bait the simple trap mentioned on page 108, they should be killed by cutting them asunder with a spade, or other sharp-edged instrument. Now, I flatly oppose this mode of destruction, firstly because it is cruel, and secondly because it is not necessarily effectual.

First, as to the cruelty, I am aware that, as a general fact, the sense of pain is very slight in the molluscs, though that of touch is highly developed. They will endure injuries which would be instantaneously mortal to a human being, and, to all appearance, suffer little but a temporary inconvenience. They have been observed to feed quite unconcernedly, while one of the carnivorous molluscs has been slowly rasping away the flesh, an act that in our minds conveys ideas of the most frightful torture.

Still, to sever into two parts an animal that possesses a well-developed nervous system must produce an amount of suffering which, although it is not equal to that which we should endure from a much slighter injury, is yet as great as the creature has the capacity of feeling. The tenacity of life is so very great in these creatures that the severed portions continue to live for some time after their separation, and no one can say with the least shadow of reason that it would not be much more merciful to kill the Slug on the spot than to let it die slowly of its injuries. Any pang inflicted needlessly, whether it be of actual pain, or hunger, or even uneasiness, is a cruelty, and therefore I say that to chop a poor Slug in two, and leave it to die by hairbreadths, is a cruel process.

As to the inefficacy of the deed, there are several reasons to be brought forward. We must not judge other beings by ourselves. If either the reader or the writer of this book were decapitated by a guillotine, or separated into two equal portions by a Life-guardsman's sword, or smashed flat by a blow of the steam-hammer, we should not survive the operation for any very great length of time. But the Slug may undergo any of these operations, and not only refuse to die on the spot, but may possibly recover altogether.

Many of the lower animals possess this strange tenacity of life, a fact which is very hard to be impressed upon the generality of mankind, who are often most cruel just where they mean to be most merciful. Ladies, for example, when a wasp worries them, and they succeed, after much flapping, in knocking it down with their handkerchiefs, *will* snip it in two with their scissors, thinking that they are killing it on the spot, whereas the body of the insect will live, and run about, and attempt to fly for hours; and even if we assert that it does not suffer pain, the loss of the other moiety must at least be very inconvenient.

There is one of the great ants of Australia which invariably suffers a similar fate whenever it meets with man. It is very large and very powerful, and very fierce and very venomous; and when it runs near a man, the ordinary mode of proceeding to take out a knife and chop it across. The two halves, once severed from each other, appear to be actuated by a spirit of mutual revenge, which even outdoes the proverbial quarrels of relations. Each half seems to think that the other has been the cause of the injury, and so they attack each other with an acrimony that ceases but with the tardy death that sooner or later asserts its powers. They go tumbling over and over, to the great delight of the real assailant, who enjoys the double advantage of securing a sight of a battle, and, at the same time, of freeing himself from the attacks of the pigmy but redoubtable foe.

As to the Slug, it is found that it possesses, in a wonderful degree, the power of reproducing lost portions of its body. Not only have the tentacles been severed and reproduced, but the whole head has been shorn away, and, in process of time, a new head, complete in all its parts, has been produced. The foot has been removed and reproduced, and the same phenomenon has been observed in the other portions of the animal.

There are several Slugs found in this country, such as the Black Slug, the Great Grey Slug, and the Landsole, found so plentifully in gardens.

ONE species of slug there is, which may be found in our gardens, but which certainly ought not to be placed among the garden foes, though we may perhaps doubt whether it has any claim to be ranked among our friends. This is the TESTACELLA, a rather elegant little slug, moderately long in form, tapering towards the head, and with an ear-shaped shell stuck near the extremity of the body. It may easily be distinguished from the other slugs by its general shape, by the prominent shell, and by the two grooves on the upper surface, from which radiate a number of vein-like furrows.

Except at night, the Testacella is seldom seen, for it is peculiarly subterranean in its habits. It does not feed upon vegetables, but is carnivorous, its food consisting almost wholly of the earthworm. Strange though such an assertion may seem, it is perfectly true that the Testacella is able to chase the earthworm through the windings of its devious course, and that it tracks the annelid just as a weasel will track a rabbit. Indeed, when the creatures are compared together, the two cases seem to be very analogous.

In order to enable it to secure that active and really powerful prey, on which it feeds, the Testacella is armed with a most formidable instrument of destruction.

TESTACELLA.

In order to explain this, and several other points in the economy of the slugs and snails, I must briefly describe the remarkable structure of the tongue.

In these molluscs the tongue is very unlike the same organ in ourselves and most other members of the animal kingdom. It does not issue from the mouth, but is of a tubular form, and passes beneath the mouth. The extremity of this tube is opened, and the sides spread out, and upon its interior are row upon row of minute but most sharp and powerful teeth, differing in shape, number, and arrangement, according to the genus, or even the species of the mollusc.

In the Testacella, the tongue is peculiarly adapted to the services which it has to perform. It is armed with a vast number of teeth, about two thousand in number, each tooth being long, slender, thickened in the middle, sharp-pointed, and barbed. On either side of the tongue-ribbon these teeth are set, their points being directed inwards, and their serried ranks taking a slight curve. It will be seen, therefore, how terrible must be such an instrument when furnished with muscles to work as well as with teeth to cut. It is, indeed, a weapon of most trenchant character, and can speedily make a hole even in the tough skin of the earthworm, which is no more able to resist it than can brass resist the file.

The reader who is fortunate enough to possess a good microscope may find much amusement, as well as instruction, in examining the tongue of the various molluscs. They require some care and cautiousness of handling before they will display themselves properly; but in a short time the needful dexterity of hand will reward the persevering inquirer, and these beautiful objects will be seen in all their wonderful perfection. They ought to be mounted either in fluid or in Canada balsam; and if the polarizing apparatus is to be used in examining them, the latter is the best substance to bring out their full beauty. The number of these teeth is very variable in the different species of slug; the Testacella having, as has been seen, about two thousand teeth, while the great grey slug possesses more than ten times that number.

The little prominent shell, which has already been mentioned, is, in spite of its diminutive proportions, a very useful piece of defensive armour. When the Testacella pursues the earthworm in its mazy course through the earth, it would have a particular objection to finding itself made the victim of a similar attack.

Here, then, lies the real value of this apparently trifling shield. As the slug draws its slow and silent course through the tunnels of the worm, the shell serves to block up the passage, and at the same time acts as a shield by which the whole body is guarded.

In dry weather the Testacella retires to its private quarters, and should the drought be of long continuance, it forms for itself a kind of hasty nest or improvised cocoon, simply by means of the slimy substance which it pours forth with such profusion. The cocoon is tolerably strong, and if broken the animal may be seen in a state of semi-torpor, enveloped in its delicate white mantle.

It will be seen, therefore, that the Testacella cannot be considered as one of the garden foes, and as it is as yet uncertain whether its labours in worm-killing are to be considered as benefits to the garden, or as having no influence whatever upon its welfare, we may as well act upon a maxim already propounded, and give the creature on trial the benefit of the doubt.

POSSESSED of equal voracity with the slug, but being perhaps one shade less injurious than the mollusc, the SNAIL is hated by the gardener with a hearty detestation. It is more generally known than the slug because its habits are more conspicuous. A slug may trail its length of obese body along without drawing the attention of the bystanders, while the Snail must perforce carry his large house openly on his back, and thus make itself too conspicuous to be readily overlooked.

The marks which the Snail leaves behind it after its ravages upon the fruit and herbage are of a nature that proves the animal to have possessed a very powerful set of teeth and muscles equally strong to move it. In truth, the "tongue-ribbon" of the Snail is beset with its ranks of teeth as thickly as those of the testacella, the chief difference being that they are curiously modelled instead of resembling rows of translucent nails. Their number, too, is very great, upwards of twenty thousand teeth being the usual average in this genus. If viewed by means of polarized light, those which are mounted in Canada balsam become magnificent objects, glowing with all the colours of the rainbow, and exhibiting their minutest details with a perfection that is never obtained by any other process.

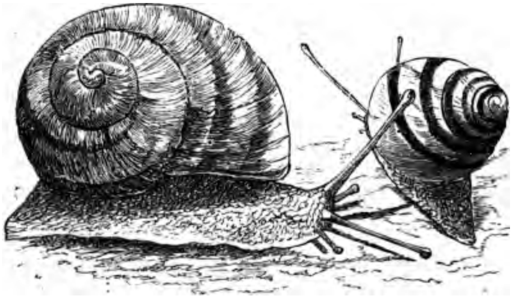
There is hardly a more formidable instrument in all nature than the tongue of one of these molluscs, which looks, under the microscope, exactly as if row upon row of shark's teeth had been set upon a tough and muscular ribbon, capable of acting as a file or a saw as the case may be. Their irresistible power is well shown in the tongue of the whelk, which can drill a hole through the hardest shell that covers the molluscs on which it feeds.

Some of my readers may possibly have seen the wonderfully ingenious armour made by the South Sea islanders, and now deposited in the United Service Museum. Among other portions of this panoply are to be seen a pair of gauntlets made of fibre, and set thickly on the under surface with the lancet-edged teeth of the shark. A blow from one of these terrible weapons will deluge a man in his blood, streaming from a hundred wounds, and by a single movement of the hand the body of an enemy can be torn open as if by a tiger's paw. Now, this terrible gauntlet, though of course of much ruder workmanship, is so exactly like the tongue-ribbon of a gasteropod, that were it not for the impossibility of a savage having seen that wonderful organ, we might well think that it had been used as a model.

If the reader should take an interest in the works of nature, let me strongly recommend him to examine the tongue of every species of slug and snail that he can find, whether it belong to the land, the sea, or the fresh water.

There seems to be no bound to the diversity of their shape, and even the tiny teeth themselves possess an individuality so marked that from two or three only of these objects an experienced eye will at once determine upon the creature from which they were taken. Some, as in the doris, look like rows upon rows of iron rakes with long, curved points; some, as in siphonaria, bear an equal resemblance to garden hoes; some, as in the trochus or top shell, resemble tiger's claws, sharp as needles at their points and barbed along their trenchant edges. Others, as in the testacella, resemble transparent bayonets; others, as in the great helix or snail genus, are rounded and tuberculated; while in many cases the form of the teeth is quite unique, and cannot be likened to any object with which we are acquainted.

The largest of our British snails is the **Edible Snail**, not indigenous to our country, but imported from the Continent many hundreds of years ago, and acclimatized to the locality. Except in certain parts of England, it is not seen, being nothing of a wanderer, and content to remain near the spot where it was hatched. In England, this Snail, being left to its own devices, does not grow to any very great size, but on the Continent, where it is kept for the market as we keep oysters, and fattened by artificial means, it attains very great dimensions. There are regular snailleries, if we may so translate the word *escargotoire*, in which these creatures are kept until they are considered to be fit for the table. They are supplied with an abundance of herbs, forming a layer about six inches in depth, among which the molluscs revel at their will.



GARDEN AND BANDED SNAILS.

Such Snails are held as great luxuries, and there really seems to be no reason why they should not be as good as oysters. I never tried the flavour of the Snail myself, but those who have done so are unanimous in praising its delicacy and richness. The Snails are in great requisition during Lent, as they are not included in the list of those edibles which are prohibited by ecclesiastical law during the forty days' abstinence. The flesh of the Snail is easily digestible, and contains much nutritious power in proportion to its bulk.

It is said in some books that this is the only species of Snail that is eaten. This assertion is, however, far too sweeping; for the common Snail of the garden and the field (*Helix aspersa*) is a very ordinary article of diet in many parts of the Continent, and in some portions of England. I have often, while in France, seen the agricultural labourers preparing their mid-day meal from the common Snail, choosing the largest and fattest specimens, and cooking them on an iron plate, over charcoal.

Except in popular prejudice, there really seems to be no reason why we should not revenge ourselves on the Snail by making it feed us, and so place its ravages on the herbage on a par with the pasturage consumed by sheep and cattle. It is a remarkably clean feeder—far more so than many creatures which we eat without scruple, mostly, I presume, because they live in the sea, and we do not witness them at their repast. All the tribe of crabs, lobsters, shrimps, and prawns, for example, are carnivorous, and will hold great festival on drowned sailors. The whelks, again, are equally carnivorous, and not only eat other molluscs, but revel on any animal substance which they can find. But the Snail feeds only on fresh leaves, herbage, or fruit, and is certainly more suited for our tables than the carrion-eating crustacea.

Like the slug, the Snail hibernates, retiring into winter quarters as soon as the frosty weather has set in, and there remains until the warm sunbeams of spring awaken it from its long sleep, when it sets off afresh on its destructive labours, unless it be rudely checked by the intruding beak of the thrush.

The slimy secretion which has already been mentioned is of signal service to the Snail during this period. If a Snail be removed from its hiding-place, and examined, the animal will be quite invisible, the aperture being closed by a tolerably strong and rather brittle film. On breaking this wall, another will be discovered at a little distance behind it, and behind this another. Sometimes there are as many as five or six of these films, air being contained between their walls. The animal forms these curious partitions almost entirely from the slimy secretion which it produces in such abundance.

The process by which these walls are formed is very simple. The Snail draws its foot just within the orifice of the shell, and then suddenly throws out a quantity of mucous, which in a very short time "sets" like plaster of Paris, and forms a rather hard layer of whitish matter. When this is sufficiently firm, the Snail detaches its foot, and contracts itself a little further into the shell, when it forms another wall by the same process. This it continues until it has completed the needful number of partitions, and has withdrawn itself into the deepest recesses of its shelly home. When the warm breath of spring summons the Snail again to life, it breaks away each partition separately with its foot, the last being the strongest, and requiring the greatest amount of force.

The cell in which the creature resides during the winter is a sort of cocoon made of earth, leaves, and similar substances, and is held together by means of the slime, which acts as water on cement, and enables the Snail to fasten together the dry materials of its nest. The surface of the foot is applied to the substances which are selected for the purpose, and a profuse supply of slime is poured out upon them. The Snail then moves the aggregate mass to the spot where it is wanted, and, after waiting till it is tolerably firm, it throws out a little more slime, removes the foot, and proceeds to work on a second mass. This is placed by the former, and cemented together firmly by the slime.

By a constant repetition of this process, a complete arched cell is formed, the operation occupying about three days. After the cell is completed, the Snail forms the successive walls or *epiphragm*, as they are scientifically called. It may be here mentioned that the epiphragm has always a minute opening opposite the respiratory aperture of the mollusc.

The reader will doubtlessly have observed that a similar and almost identical process is employed in the formation of the epiphragm and the construction of the cocoon. This cocoon is mentioned, not only because it forms an essential part of the history of the Snail, but because it gives a clue to the reason why we find so much difficulty in discovering these creatures which conceal themselves during the winter. Even if the cocoon itself were found, it is not every one that would conjecture its real nature.

I do not wish to make this volume a mere dry catalogue of creatures that injure or benefit us, but to inspire an interest in our garden foes, and to show that even in the most noxious of these enemies there are many points that call for our admiration. Therefore, I intend to carry out, through the volume, the plan which I have hitherto followed, and to give a brief, and I hope intelligible, account of every peculiarity of habit or structure that seems likely to attract general interest.

Any one who studies the habits of animals must feel greatly interested in watching their instincts, and the useful manner in which they are directed to their food. We cannot but ask ourselves, by what sense it is that the Snail is enabled to discover the presence of suitable food from a distance, and to move towards it as correctly as if it had previously learned the road. Sight cannot guide the creature, because the minute eye-specks on the tentacles of the eye, can but admit a very few rays of light, even if they serve at all for vision analogous to our own.

Can it be through scent that the Snail is directed in its course ? or is it not rather through some perceptive power, of which we ourselves have no consciousness ? This latter theory appears to be the strongest, and has been already put forward by Mr. Knapp. "Ignorant as we are of the scope, limitation, and even existence, of certain faculties in animals, we can frequently do little more than conjecture the means whereby they perform many of the functions of life. This ignorance leads us naturally at times to refer their powers to the agency of senses like our own, but in most instances probably without any foundation in truth.

"No creature seems less qualified to commit the depredations which it does than the garden Snail. We grieve to see our fruit mangled and disfigured by these creatures, but cannot readily comprehend by what means they obtain the knowledge that its maturity is approaching, though we find that they must be imbued with some faculty capable of accomplishing the purpose; for no sooner does a plum, a fig, a nectarine, or other fruit, begin to ripen on the wall, and long before any sensible odour can be diffused from it, even before an experienced eye can detect the approach to maturity, these creatures, the slug and the snail, will advance from their asylum, though remotely situated, and proceed by very direct paths to the object. This probably cannot be by the guidance of any human faculty. . . .

"If they possess the sense of smelling, in them it must be a very exquisite sense, beyond any delicacy we can comprehend. Thus, excluding human means of comprehension, which appear inadequate, we more reasonably conclude them to be endowed with intelligence for effecting intentions of which we have no perception, and which we have no capacity for defining. The contemplative man finds pleasure in viewing the ways and artifices of creatures to accomplish a purpose, though he knows not the directing means; and it justifies the convictions of the believer, by giving him fresh evidence of the universal superintendence of his Maker, that even the slug and the Snail, which are arranged so low in the scale of creation, are yet, equally with all, the objects of His benevolence and care."

THE fables of ancient mythology find their parallels in the facts of the every-day world, and there is scarcely one of the wild and wondrous fancies with which the imaginative minds of the early poets bedecked their allegorical teachings that cannot be exhibited by the physiologist in the material world. Among other impersonations, the enacted hieroglyphs of the olden times, one seems to have survived and preserved its freshness to the present day. Once at least every year, on the fourteenth day of February, the shop-windows are filled, and the postman's bag is laden, with figures of Cupid and his darts, the acknowledged emblems of love and its pleasing pains.

Yet the ancients did not know that among the lower animals the darts of Cupid were not an allegory, but positive material facts, and that though the mythological Cupid be not known among the Snails, his darts exist, delicate, as they ought to be, crystalline, and penetrating. The Loves of the Snails would make a subject for a poem, original as "Homer's Iliad," and tender as Petrarca's sonnets. They are such strange and wonderful creatures, that it is difficult to find a proper commencement to their history.

In them a second mythological fable finds more than a parallel, and the reality of nature even surpasses the imagination of the poet. We all know the pretty tale of the offspring of Hermes and Aphrodite—Mercury and Venus, as unappreciative readers translate them. How the beautiful youth went to bathe in a fountain at Caria, and how the nymph of the fountain straightway fell in love with him. How she took the privilege of leap-year, and besought him for his love, but in vain; and how, finding that his young heart was obdurate, she prayed the gods to blend them into one being. And how the prayer was immediately granted, and the youth and the nymph melted into each other's form, and were for ever inseparably united. The creator of this elegant fiction, wherein is contained an allegorical emblem of true wedlock, had but little idea that he might have crushed under his foot, on the day when he conceived his immortal image, a creature which fulfils all the realities of this man-woman: for the Snail is equally masculine-feminine—it is, at the same time, a husband and a wife, a father and a mother, and carries out in their utmost perfection the duties of both sexes. Here, then, we find the fable of Hermaphroditus to be a living reality, though without the poetical accessories of the fountain, the nymph, and the sympathizing gods.

Animals in a wild state are only attracted towards each other by love at certain times of the year, the reason being that the future progeny should be ushered into the world at a suitable time. Snails, like other beings, are subject to this law; and, at the proper season of the year, the universal passion begins to assert its dominion over them.

Any one, on seeing, for the first time, two Snails approaching each other, would never think that they were urged by matrimonial intentions, and, if told that such was the case, he would fancy, with Mrs. Malaprop, that it is always best to begin with a little aversion.

For, as they approach, each slowly produces, from a hidden sheath, or quiver, if we may so term it, a beautiful little dart, about as large as a sewing-needle, but flatter and not so long, and of crystalline translucency. With this weapon it attempts to wound its antagonist, or lover—for the two words seem, in this case, to be convertible terms; while the other uses its best endeavours to avoid the blow, and seems to fear the stroke of the dart. At last, however, the sharp point is successfully struck into the soft body, and is then mostly broken off or falls to the ground. The other Snail then proceeds to go through the same manœuvres, and not until it has been equally successful do they think themselves at liberty to enter upon matrimony. It is a kind of betrothal, a signature of the marriage-contract written mutually upon their bodies.

Shortly after this remarkable weapon was discovered, and its use ascertained, the really wonderful narrative received several improvements at the hands of the repeaters, some of whom absolutely declared that the darts were projected through the air, as out of bows, and that the two Snails kept up a discharge against each other. There is even in some book—I think in Shaw's voluminous "Zoology"—a very spirited illustration of this molluscan duel, with the darts flying through the air and stuck in the ground, just as arrows are represented in old battle pieces.

I hope that the reader will not fancy that I myself am drawing a bow of some length in narrating this curious history. I can assure him that it is perfectly true. I have often seen the darts, and he can do so also, if he likes, merely by catching a Snail *before* the season of love, and looking in the right place. On opening the body at the side of the neck, a moderately sized purse-like sac will be seen, having strong muscular walls. If this sac be carefully slit open, the dart will be discovered lying within, its root affixed to a kind of fleshy tubercle at the base of the sac. It will be seen, therefore, that, when the sac is inverted—an act which can be achieved at the will of the animal—the dart will protrude externally. In length it is not quite half an inch; and, after it is broken, it is renewed by growth from the fleshy tubercle on which it rests.

The real object of this dart is exceedingly obscure, and th function which it exercises is an enigma to which a key has no been found.

Having now given a few lines to the loves of the Snails, w will proceed to their offspring.

The Snail lays a considerable number of eggs, which are deposited in the ground, under which the parent burrows for th purpose. In digging a garden, it is not an uncommon result t find a Snail busily engaged in this operation, and to throw ou with the earth the parent Snail and a number of eggs. Thes eggs are very pretty-looking objects, round and pellucid, lik gelatinous peas, or perhaps more like the spawn of the salmon Of course they should be destroyed as soon as seen, unless th discoverer wishes to make experiments upon them. Care shoul be taken that they really are destroyed, for the vitality in them i very strong, and will not be expelled save by the harshest measures.

The eggs of some of the larger tropical snails are oval, and o very great size. Those, for example, of the Achatinæ of Africa, and the Bulimi of Brazil, Snails which attain a length of eight inches the eggs are rather more than an inch in length, and are covered with a hard shell, like that of a bird's egg. Indeed, if several of these eggs were placed in the nest of a foreign bird, they would pass muster with most persons. Several fine specimens can be seen in the collection at the British Museum.

Even in the perfect mollusc the tenacity of life is wonderfully great; and the injuries which a Snail will suffer and the privations that it will endure, and yet live, are almost incredible.

Some persons, when they have taken a Snail, fling it to the ground, or against a wall, and think that they have killed it, because they know that if their heads were crushed like the shell of the Snail they would be killed on the spot.

Certainly it mostly does happen that the Snail perishes, because there are sharp-eyed birds ever on the watch, who are only too glad to take advantage of a Snail-shell broken without costing them any trouble; but if the creature escapes from that danger, it is not at all unlikely to recover, to mend the broken shell, and to resume its destructive labours.

It has often happened that Snails which have been sent to this country from the tropics as empty shells, and then placed in the cabinet, have proved their vitality by showing themselves out of their shells. Even the large tropical Bulimi have survived for more than a year.

One instance, however, mentioned by Dr. Baird in the "Annals of Natural History," for 1850, is so remarkable, that it deserves a few lines in this place. A specimen of the Desert Snail (*Helix desertorum*) had been sent from Egypt to the British Museum, and was fixed to a tablet in the usual manner. There it remained, apparently nothing more than a dry empty shell. But, in the year 1850, the white paper on which it was fixed was observed to be stained, showing that the creature was living, and had come out of its shell, but had retired and reclosed its mouth with the usual epiphragm. The Snail was then removed from the tablet and put into warm water, when it made its appearance in perfect good health, having endured an imprisonment of four years fixed to one spot, in a dry place, and without any possibility of procuring food. To this period of four years must be added the time which must have elapsed between its capture in Egypt and its being placed on the tablet; so that this mollusc had clearly lived for a period considerably exceeding four years under the most unfavourable conditions that can be conceived.

Drawings were taken of this wonderful Snail, and a very good portrait of it may be seen in Woodward's "Manual of Molluscs," page 7.

I have found that the solution of ammonia already mentioned is as fatal to Snails as to slugs, and that if their shells are broken and they are thrown into a vessel in which is a supply of tolerably strong ammoniated water, their death is certain. If fowls should be kept on the premises, the Snails should be reserved for them. The shells of the Snails must be broken, or otherwise the fowls waste so much time in getting at the inmates, that many of them crawl away and escape while their companions are being slowly murdered.

As to the precautions that are to be taken against them, those which have been mentioned while the slug was under consideration will answer equally well for the Snail, whose body is of a similar consistence, and whose habits much resemble those of the shell-less molluscs.

There are many more curious details which might be narrated of the Snail, such as the wonderful and complicated mechanism of the foot, by which the Snail is enabled to glide over the ground, and to perform so many offices. The shell, too, is well worthy of attention, with its beautiful structure, as seen under the microscope and revealed by means of acids and other chemical aids; and the method by which it receives its beautiful and varied colouring is also most interesting. I had noted all these points for description, but finding that so much space has already been occupied by the Snail and the slug, I am compelled to pass to the succeeding class of animals.

Still, I trust that, even in the limited space which can be afforded to one group of animals, I have said sufficient to show that not only are the Snails and slugs injurious to our gardens, and to point out some simple and easy ways of checking their ravages and thinning their numbers, but have also proved that even in these despised and detested animals there is much to admire, and that, though so lowly in the scale of creation, they are not destitute of interest.

CHAPTER VII.

CRUSTACEA.

CRUSTACEA, and their Character—WOODLICE: their right Position in Nature—Various Species of Woodlice—Their Voracity—Account by Dr. Fitch—Used as Food for Poultry—Supposed medicinal Properties—The Pill Millipede—Woodlice Traps—Description of the chief British Species—Eggs of the Woodlouse.

ON seeing the word Crustacea placed at the head of a chapter, the non-zoological reader may perhaps feel some surprise. Knowing that in the crustacea are the crabs, the lobsters, the crayfish, and the shrimp, all marine or aquatic animals, he may perhaps wonder that any crustaceans should exert any influence, good or bad, on our gardens.

The creatures, however, which we are about to examine were not known to belong to the crustacean class until comparatively recent times, but were placed by some among the spiders, and by many writers among the insects, in the latter of which groups they are ranked by the general public. I allude to the WOODLICE, or SLATERS as they are often called.

These mischievous little creatures are as true crustaceans as any which we purchase at the shops, but they belong to a different division of that great class. The eyes of the crabs, lobsters, and all crustacea which we bring to table, are set upon footstalks, and more or less moveable; but those of the Woodlice are placed directly upon the surface of the integument. These creatures, of which an enormous number of species inhabit the seas, rivers, and dry lands of our country, are therefore called appropriately Sessile-eyed Crustacea. Those who wish to be thought scientific employ a very long word, "Edriophthalmata," a word which has exactly the same meaning, but has a more learned look about it.

Several species of land Woodlice are already known to exist in England, and it is probable that in course of time, when the history of these beings is a little more studied, other well-defined species will be discovered. Those which are most frequent will be described, and a brief notice of their habits will be given.

The Woodlice are—at all events in this country—injurious to the gardener, inasmuch as they are very voracious, and eat the outer skin of many plants, besides infesting the ripening fruits. They are especially apt to crawl into cucumber frames and similar localities, whence they cannot readily be expelled, but into which, when once the intruders are exterminated, a second immigration can mostly be prevented by the use of proper means.

I am obliged to add the saving clause, "in this country," because Dr. A. Fitch, in his report on the noxious, beneficial, and other insects of the State of New York, declares them to be perfectly harmless. His words are as follows: After speaking of these crustaceans, he proceeds to say that "they are plentiful about the roots of trees, under logs and stones, in the crevices of the foundation walls of our buildings, and in our cellars, and they are particularly numerous under any logs or billets of wood. They occur, in short, in all situations that are damp, cool, and dark. Frequently by night, in wet weather, they crawl about the rooms in our dwellings. They are perfectly innocent and harmless, subsisting on decaying vegetable and animal substances. They afford a dainty bit to domestic fowls, which devour them with avidity, and are always scratching our yards in search of these more than any other article of diet. This is their chief importance in an economical aspect; and being so abundant, they form an item of no small value to the poultry breeder, though one of which but little notice is taken.

"In former times the species of this family were highly reputed for their supposed medicinal virtues, and old books upon the Materia Medica inform us that, when dried and pulverized, 'they have a faint, disagreeable smell, and a somewhat pungent, sweetish, nauseous taste, and are highly celebrated in suppressions, in all kinds of obstruction to the bowels, in the jaundice, ague, weakness of sight, and a variety of other disorders.' And the wine of millipedes, prepared by crushing these animals when fresh, and infusing them in Rhenish wine, is spoken of as an admirable cleanser of all the viscera, yielding to nothing in the jaundice.

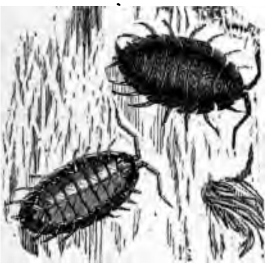
"In the light of modern science, we can impute the cures attributed to these creatures only to the effect produced upon the imagination of the patient and the curative powers of nature, for, beyond some slight demulcent qualities, they must be wholly inert, and are now wisely discarded from the pharmacopeias."

Nevertheless, I have seen a drawer half filled with the Armadillo Woodlice, rolled up, as is their wont when alarmed, and was accustomed to use them as projectiles rather than for medicinal purposes. From one remark in the passages quoted above, it seems evident that the pill millipede, of which we shall treat in its place, is confounded with the Armadillo Woodlouse.

From the above-mentioned passages, it is evident that the Woodlice are useful creatures in their proper place, but that their proper place is not the garden. They are needed in the forest and the open land, where they do good service by eating the decaying trees and other vegetable substances; but when they invade the garden, and take to eating our plants, the case is altered, and they must either be destroyed by direct execution, or handed over to the poultry, who perform that operation with eager celerity. They may be captured without much difficulty, by preparing a locality for them such as they have lost.

All the species require moisture, and thrive best in damp places, dying if kept for a long space of time in a really dry atmosphere. Also, they love darkness and sheltered crannies, seldom appearing during the day time, and by a judicious blending of these requisites the Woodlice can mostly be enticed into spots whence they can be taken at will. Perhaps the very best and simplest plan is, to lay a large slate in a sloping position against the wall, and then another slate upon it, keeping them about a quarter of an inch apart by little bits of wood. If the ground on which the slabs rest be well watered, so that the moisture shall be exhaled about the slates, the Woodlice will flock to the spot, and may be captured by merely removing the upper slate.

When, by these or similar means, the frame has been cleared of the Woodlice, they may be easily kept off by painting a tolerably broad band of gas tar round the woodwork of the frame. The Woodlice detest the contact and odour of gas tar—as they may well do, if they have any organs of smell, or any discrimination of touch—and as they can neither fly nor leap over the obstacle, they are effectually prohibited from making good their entrance.


LAND SLATER.—*Oniscus asellus.*

Having now given a general account of the habits of these troublesome creatures, I will proceed to describe the form and appearance of the more conspicuous species.

The common LAND SLATER (*Oniscus asellus*) has a smooth body of a darkish grey colour, diversified with two rows of yellow spots on the back, and the same number of white spots on each side. This species is mostly found about out-houses and in gardens, always choosing the darkest and dampest situations. Another species, called the BROWN SLATER (*Philoscia muscorum*), is usually found among damp moss at the roots of trees and in similar localities. It may be distinguished from the common Land Slater by its colour, which is brown, sometimes having a reddish tinge. On the upper surface of the body are a number of tiny grey or yellow dots and markings.

The ROUGH LAND SLATER (*Porcellio scaber*) may be distinguished by the character from which it derives its name. Its body is oval, wide, and very rough, the little projections being best marked on the front portion of the body and on the head. The colour of this creature is dark slaty brown, sometimes splashed any system. It is, of course, needful that the work shall proceed in an orderly manner, so as to avoid confusion and insure intelligibility, and I shall therefore take the insects as I have taken the vertebrated animals and molluscs, in the order which is accepted by the best authorities. Those who have already studied practical entomology will stand in little need of the book, and will understand that it is not addressed to them, but to those who know little of the habits of our British insects.

It is also right that, in order to avoid cavil, I should mention one fact. Several insects will be classed among our garden friends and foes which are very seldom seen in the garden at all, but remain in the forest, the field, or the plain. As, however, they exercise an influence on the garden, though remote from it, they have a right to be treated according to their deeds, and not according to their proximity; just as blockading ships may be considered as enemies and relieving ships as friends to a land on which they never rest.

The reader must also be warned that he may not be able to discover the creatures of which he reads, and may fancy, therefore, that his garden is free from them. Still, it does not follow that an insect does not exist because it cannot be seen. Many of them are notable for their persistence in avoiding the light of day. They burrow into all kinds of substances, they creep into the darkest crannies, they hide under stones, and conceal themselves beneath the rugged bank of venerable trees: they lead subterranean or sub-aquatic lives, and so flourish unsuspected by the senses of man. To find a given insect two requisites are needed—first, that its haunts should be known; and secondly, the eye should be trained to see it. The knowledge of the dwelling-place will be supplied in the following pages, the education of the eye will come by practice.

BEETLES.

As the Beetles are now by common consent placed at the head of the insect tribes, they will in this work take their rightful precedence.

CHAPTER VIII.

INSECTS.

INSECTS—Their Influence and Importance—The value of Patience—Advantage of Education to the Agriculturist—The Land and the Mind—Opinion and Reason—The real Aim of the Naturalist—Rights of Man—Fiction and Reality—BEETLES—Their Characteristics—The TIGER BEETLE—Its Habits and Food—Its Larva, the Habitation of the Grub, and Mode of Capture—Colour of the Beetle—Its Mode of Flight—Its Pleasant Odour—The GOLDEN GROUND BEETLE—Its Food and Mode of Life—Jaws and Head—Habits of the Carabidæ—Le Vinaigrier—The BOMBARDIER BEETLES—Origin of their Name—The CALOSOMA—Its Habits and Food—Its Value to the Gardener—Ingenious Contrivance—The PROCRUSTES and its Food—SUN BEETLES—Their Habits and Use—The Colours and their probable Object—COCKTAIL BEETLES—Their General Habits and Popular Titles—Courage of the Cocktail—Its Evil Odour—Food of these Beetles, and their Value to the Gardener—The Earthworm and the Cocktail—A Strange Dwelling-place—Summary.

IN the single word which heads this chapter is comprised the bulk of our garden foes, and no few of our garden friends.

It is wholly impossible to overrate the influence which is exerted by the insect tribes upon our gardens. Famine and plenty depend upon their presence, and the fate of nations may be determined by a beetle. I think that few things are so calculated to impress us with the importance of petty details as the vast work which is daily performed by the familiar insects which we scarcely heed.

"Naught is great
Nor small with God—for none but He can make
The atom indivisible, and none
But He can make a world: He counts the orbs,
He counts the atoms of the universe,
And makes both equal—both are infinite."
FESTUS.

So with the insect tribes. We admire some for their beauty and apparent innocence, and we detest others for their ugliness and apparent malignity. We make metaphors of them, we write fables about them, we deduce morals from them, and yet we know very little about them; we are carried away by appearances, and we judge without investigation.

With the usual selfishness and narrowness of human nature, we make ourselves the test of other beings, and value or despise them according to their direct influence upon us.

Thus it is with education and in a hundred other cases: we cannot wait for results, we want to hurry everything forward on the "go-ahead" principle. Parents care little for the training of their children's minds in comparison with precocious and abortive results.

Their boys must learn only those special branches of knowledge which will push them on in the world: their girls must play dashing tunes on the piano, instead of attaining a real knowledge of music; produce feeble landscapes, or those abominable "heads," in which the touch of the master's crayon is but too apparent, instead of learning the true science of draughtsmanship; and talk French "after the school of Stratford att ye Bow," rather than learn to write it grammatically and read it fluently. They want everything for show, everything for appearances, and care nothing for the real objects of education.

In fact, their minds are so wholly concentrated on self, have so narrow a boundary and so limited a prospect, that they reject everything that does not apply to themselves personally and produce immediate results.

I really think that the slow growth of trees and vegetation generally is a great blessing to us. It teaches us that there are *some* things for which we must be content to wait. It shows that rapidity of growth and weakness of constitution are inseparable, and that the hardest and most valuable timber must be the work of centuries, while the fragile herbs may be run up in a season. There is no small lesson in nature if we will only try to read it. The best seed fails in ill ground, and the gardener's surest hopes of good crops rest on the preparation which he has given to the soil. It is very troublesome, it makes no show, it produces no immediate results; but his harvests are his reward. So with the human mind. It must be dug and trenched and manured and prepared for the seed before a goodly harvest can be obtained, and the true teacher will wait patiently for the results of his labours.

We may seem to be travelling out of the record in these observations, but such is not the case. I am certain that if our farmers had been better taught to use their minds, they would be better capable of exercising their judgments. A new race is now springing up, and it is upon these that the prosperity of the country greatly depends. They have a better education, their minds have been better trained, and they have learned to look beyond the present, and not to take for granted everything that has been traditionally handed down to them from the records of the past.

The only safe plan is to take no *ex parte* statements, but to weigh without prejudice the arguments on both sides of a question, and to be guided by reason rather than opinion. I cannot but suggest, by the way, that we think far too much of our opinions. We cherish them in our bosoms, we air them on all occasions, opportune or otherwise, we conceive that we have a sacred right to them, and in some measure consider them as the very charter of our liberties. Reason has nothing to do with the subject. "These are my opinions, and as a free-born Englishman I have a right to hold them!"

Now, I flatly disagree with such notions. Of course I think that no one has a right to impose his own opinions on me, nor have I a right to impose my own upon another man; but I do say that there are cases where a man has no right whatever to his own opinions. We have all a right to our property, but if that property should be a nuisance to our neighbours, the law compels us to relinquish it. So, when a man's opinions are a nuisance to his neighbours, he has no moral right to retain them.

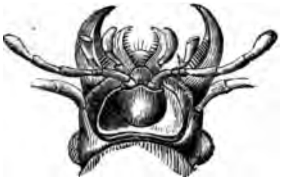
Supposing that my opinions lead me to the conclusion that I am performing a public service by filling my garden with chickweed and groundsel, or distributing a few bushels of wireworms among my neighbour's wheat, I have not the least right to hold those opinions; and if my opinions lead me to kill all the birds that would destroy the weeds and eat the noxious insects, I have surely no right whatever to hold, much less to carry out, such opinions. In point of fact, opinion and obstinacy are convertible terms, and when a man says to me "such are my opinions," I always understand him to mean that he is very opiniated—in other words, very obstinate.

The highest wisdom is necessarily the right interpretation of God's works, and the loftiest sages are the truest interpreters. The chemist, the mathematician, and the anatomist are but the discoverers of facts previously existing, and the chief object of the naturalist ought to be to discover the object for which the various creatures were placed in the world. We must take for granted that, as all things were pronounced to be very good, and as it is evident from the records of all science that the animals which now exist formed, at that far distant time, part of the living creation, we must come to the conclusion that even those creatures which are most noxious to ourselves and destructive to our crops were, at all events, intended to play some indispensable part in the scheme of the universe.

Gifted as is man with the empire over all inhabitants of the earth, on which he is for a time placed, and ranked but a little lower than the angels, he has a perfect right to exert his divinely given authority over those beings which, though his fellow-creatures, are yet his subjects by the tenure of their existence. To use and not to abuse his high position should be his constant endeavour, and like a good monarch he should be jealous of the lives of his subjects.

Perhaps one of the very highest offices of a civilized country, and that which more especially marks its progress in refinement, is the machinery which it possesses for distinguishing the good from the bad, for detecting and punishing the criminal, and discovering and encouraging the industrious and peaceful citizen. So ought we to exert our authority over the lower creatures, to distinguish the useful from the noxious, to encourage the one and destroy the other.

In order to enable it to perform its tasks, it is not only furnished with swift and active limbs, which enable it to overtake the slow-crawling cockchaffer, and are a compensation for the absence of wings, but is armed with a terrible apparatus for seizing and tearing, compared with which the fangs of the lion are small and feeble. The accompanying illustration shows the under side of the beetle's head, and displays the formidable series of jaws with which it is armed. In order to save space, the feelers or antennæ have been cut off in the middle of the second joint.



HEAD OF CARABUS.

A figure of this beetle may be seen on the plates at the end of the book, and the reader will at once recognise it, if he should meet with it, by its brilliant golden hue. Other species of the same large and powerful genus are abundant in this country and, though they shun the daylight, and come out to feed in the evening, on the nocturnal insects, may at any time be found under large stones, beneath the loose bark of trees, and in similar localities.

In consequence of the service rendered by this beetle, the French call it by the name of "Le Jardinier." They have also another name for it. In common with other members of the same family, it possesses the faculty of discharging an acrid fluid whenever alarmed or handled. This fluid can be projected to a considerable distance, and if it strikes the eyes will cause violent pains for some time. In consequence of this habit, it is named "Le Vinaigrier."

In one genus of these beetles this fluid volatilizes very rapidly, and produces a kind of bluish vapour, accompanied with a slight explosion, and has gained for them the expressive title of BOMBARDIER BEETLES. The scientific name of the genus is *Brachinus*, and the creatures may be found on the banks of rivers, in many parts of England. The banks of the Thames supply large quantities of these insects. They must be searched for under stones, and as they are very gregarious large numbers may be captured in one spot.

A VERY beautiful insect belonging to this family is sometimes found in dark situations, or is captured at night by means of the light shed by the entomologist's best companion, a bull's-eye lantern. This insect is shown on the plates, and is of rich deep shining green. I am not aware whether it possesses any popular name, but it is very familiar to entomologists under the title of *Calosoma inquisitor*. Both names are appropriate: the former, signifying "beautiful-bodied," is given it on account of its elegant shape and lovely colouring, and the latter is earned by its inquisitive habits.

Both in the preliminary and perfect stages of its existence this beetle may rank among the most voracious of its kind, feeding upon caterpillars of various species, and making woeful havoc among them. In England, it mostly eats those caterpillars which devour the oak leaves, and will eat several of them per diem.

An allied species, *Calosoma sycophanta*, is very scarce in England, but is plentiful on the Continent, where it is of the greatest value to the agriculturist and the ornamental gardener.

The larva is a great black, fat-bodied grub, with an oddly spiked tail, and a tremendous pair of curved jaws. It is very voracious, not to say gluttonous, gorging itself to such an extent, that, like the boa constrictor after swallowing its prey, it becomes almost comatose, and can hardly move. Unfortunately for itself, its very helplessness when in this condition is turned to its own destruction; for the creature is a cannibal, and when the hungrier and therefore more active grubs crawl across one of their brethren in this condition, they will fall upon it and eat it without compunction.

It has great capabilities for indulging its voracity, for it often makes its way into the masses of processionary caterpillars (of which we shall treat in due course), and there feeds until it can hold no more.

This species is mentioned in order to show the value of knowledge when rightly applied. But a few years ago entomology was hardly thought worthy of the name of a science, and those who studied this charming subject were twitted by critics with the title of "bug hunters." I have no doubt but that gardeners and farmers entertained a still heartier contempt for entomologists, simply because their ignorance was greater; yet we are now beginning to find that the entomologist works hand in hand with the agriculturist, and that neither the farmer nor the gardener can know his business unless he has some acquaintance with the habits of the various insects with which he daily meets.

Some years ago, M. Boisgerard hit upon a very clever expedient for clearing some trees that were infested with the caterpillars of *Bombyx dispar*. He simply procured some females of the beetle which has just been described, and placed them on the infested trees. The consequence was, that in the following season, the larvæ of the calosoma were found in the nests of the caterpillars, and in a year or two the trees were rid of these pests. Here we see an example of true generalship, playing off one insect against another, and making use of their instincts to serve the purposes of man.

There is a rare species of this family, called *Procrustes coriaceus*, which both in its larval and perfect condition feeds on slugs and snails. Our space will not permit me to mention even the names of all the British species of Ground Beetle, but their general shape is always similar, so that they can be recognised by reference to the two figures which have already been given. None of them do any harm to our crops or flowers, and for the most part they are very useful in devouring the noxious creatures that infest our gardens. They should therefore be protected and encouraged, the latter object being attained by making comfortable dwelling-places for them, such as stones, slates, and tiles laid in dark corners, and just raised above the ground by small pebbles, so as to enable the insect to creep beneath their shelter.

The beautiful insects termed SUN BEETLES, from their habit of running about exposed to the full glare of the sunbeams, are members of this family, and mostly belong to two genera known by the name of Amara and Pœcilus. They are also carnivorous, as I have often witnessed. It is almost impossible to keep any number of these insects in captivity, owing to their exceeding voracity.

Some years ago, while making a series of dissections of various British insects, I was necessarily obliged to keep a large stock of living specimens always on hand. Among others, I had a vast number of Sun Beetles and their dull-coloured allies, called popularly "imps," from their sooty black garments. At first I placed them in a moderately large box, but found that they ate each other with such astounding rapidity that the whole stock seemed in danger of disappearing. So I gave them cooked meat, in hopes that they would prefer that nourishment to the bodies of their own species.

The experiment succeeded well, for no sooner was the meat placed in the box than it was covered with the beetles, who gathered round it like a pack of wolves around a carcass, and soon formed themselves into a continually moving mass of bright and dull-coloured beetles, the meat being hidden by their bodies. It was necessary to keep up a good supply of meat for them, and I thus succeeded in keeping them quite long enough for my purpose.

Mr. Westwood remarks that in these beetles the brilliant colours belong chiefly to those species which are exposed to the full glare of daylight, and that the dark-coloured beetles are those which remain in dark places during the day and only come out at night. Perhaps this dingy colouring is given them in order to enable them to steal unseen upon their prey, unbetrayed by the glitter of a polished surface.

Every one will recognise the insects which are shown on the next page. These species have been selected as the representatives of a vast family of Beetles, varying in size from an inch in length to microscopical minuteness.

Some, as the creatures which are shown in the illustration, are so large and powerful that they can inflict a sufficiently painful bite upon the human hand, while others are so minute that they can scarcely be distinguished by the naked eye, a not even the most practised entomologist can pronounce auth ritatively upon their real nature without the aid of a magnifier

ROVE BEETLES.

They are known by various popular names, all of which a sufficiently expressive. On account of their wandering habi and quick movements, they are termed **Rove Beetles**; t custom of elevating the abdomen when alarmed or angry h earned for them the name of **Cocktails**, and one or two of t large black species are popularly known by the title of **Devi Coach-horses.**

There is a quaint and appropriate character about this titl Some years ago I made a magnified coloured drawing of t head of this insect, representing it with its jaws widely open as if in the act of seizing its prey, and the light glancing fro its polished eyes. It was a perfectly faithful sketch, drawn the help of the camera lucida, but yet, almost every one w saw it for the first time thought that it was a fancy sketch f an imp.

They are unpleasant beetles enough—fierce, active, and courageous, fearing no foe, and caring nothing for the size of the adversary. I once had the pleasure of causing a signal change of feeling towards this beetle. While ascending, in company with a small party, the steps leading from the Margate Sands to the upper regions, a great Cocktail Beetle appeared in front of us, and in the coolest manner disputed the right of passage. The ladies were rather alarmed at the insect, and much disgusted with its sullenly-ferocious aspect and sooty-black hue. However, their disgust was soon changed into admiration and amusement, for I kept the creature fighting me for about ten minutes, its determined attacks, and the fierce looks which it put on, exciting general applause. Even when at last I allowed it to retreat, I had only to strike the end of my stick on the disputed ground to provoke another attack.

Not only can it fight by means of its powerful jaws, but it is furnished with another means of defence. At the end of the tail are seen two whitish spots, which are the extremities of certain tubercles. When the creature is angered it projects these tubercles, and distils from them a secretion of most intolerable odour, not unlike that of phosphoretted hydrogen, as repulsive, as nauseating, and more enduring in its effects on the nostrils.

I may here mention that the capability of turning up their tails in their well-known fashion is given to them for a very useful purpose. Their wings are very large and the wing-cases are very small, and it is by the aid of the tail that they are enabled to pack the wings under their apparently inadequate covers.

The insect represented at the left hand of the illustration is in the larval and perfect stages of existence a most voracious creature, feeding upon animal substances, and being equally content with the bodies of prey which it has captured or with any decaying animal matter. It feeds largely on the common earthworm, and is one of the many creatures which give their aid in keeping down the numbers of that prolific annelid. The elongated shape of its body enables it to introduce itself into the holes which the worm has made, and the short, active, and powerful legs permit it to follow its prey through the winding passages of its subterranean home.

Sometimes it is baffled in a rather curious manner. My readers have doubtlessly remarked that the earthworm is in the habit of dragging leaves into the entrance of its burrow, and almost invariably pulls them to such a depth that they form a kind of hollow cone. Gardeners detest it for this, among other reasons, inasmuch as it will often drag the leaves of living plants into the hole, and so disfigure the flower to which they belong. These leaves act as barriers to the Cocktail, which is either unable or is afraid to pass them, and the worm having thus shut its door, bars out the intending intruder.

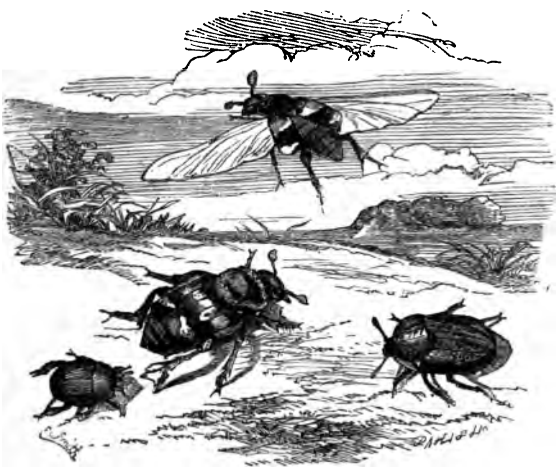
While in its larval state this insect is quite as voracious, feeding on all kinds of insects, and even devouring those of its own kind, seizing the prey just behind the head, draining the body of its juices, and then eating it, just as a boy sucks an orange and then eats the insipid pulp.

From the foregoing account, it will be seen that this insect is to be ranked among the friends of our garden, and deserves protection at our hands. It eats decaying animal substances, thereby removing that which would otherwise become a nuisance, and destroys numbers of insects, besides aiding in restricting the numbers of the earthworms. All the large species possess similar habits, and therefore the handsome species shown on the right hand of the illustration is not specially described. It may be easily known by the shining polished black of its head, and the beautiful grey down of its wing-covers with their rich jetty mottlings.

One rare species of this family (*Velleius dilatatus*) passes its early stages of life in a very strange locality, being parasitical in the nests of the common hornet—the very spot of all others which an immature beetle would appear most likely to avoid. The late Rev. F. W. Hope informed me that he has taken this remarkable insect at Southend in the autumn of 1840, and that he found it, not in the nest of the hornet, but in trees that had been perforated by the grubs of long-horned beetles, and the caterpillars of certain moths. Other species are found in the nests of ants, where they are carefully tended by these remarkable and enigmatical insects.

Some of the smaller species are not so useful, because their food is chiefly of a vegetable character, consisting of decaying leaves, fruit, roots, bulbs, and similar substances. They are very fond of eating fungi of various kinds, and under the leaf-heap the gardener will find them in profusion. One species, at least, is rather prejudicial to the agriculturist, for Mr. Westwood found its larva engaged in devouring turnips in the winter months. Still, as a general rule, they are very good friends to us and deserve protection.

The shape of the larva is not unlike that of the perfect insect —at all events, it bears a sufficient resemblance to be identified. The larvæ of several water beetles closely resemble those of the Rove Beetle, but they are entirely aquatic in their habits, and do not mix with those of the Cocktails.



MIMIC BEETLE.—*Hister cadaverinus.* BURYING BEETLE. —*Necrophorus vestigator.*
BLACK SEXTON BEETLE.—*Silpha obscura.*

CHAPTER IX.

The SEXTON BEETLES and their General Uses—The BURYING BEETLE—Its Instincts and Wonderful Habits—Its Labours—A Comparison—The Eggs and Larvæ—Value of the Burying Beetles—The Circle of Creation—Life and Death—The SILPHA—Its Habits—Its Eggs and Larvæ—Its Food—The FOUR-SPOT SILPHA and its Habits—Its Use to the Gardener—A Foe to the Snail—The MIMIC BEETLE—Its Shape, Colour, Texture, and Habits—The TRUFFLE BEETLE and its Habits—The COCKCHAFFER—Its Larva—The Form, Habits, and Voracity of the Grub—Foes of the Grub—Its Numbers and Ravages—The Cockchaffer made Useful—How to destroy the Grubs—The SUMMER CHAFFER—The BRACKEN CLOCK—Its Form and Colour—Its Habits and Ravages—Its Larva—Feigning Death—The STAG BEETLE—Its Larva and Residence—Power of its Jaws—Its Injuries to Trees—Its Transformations—THE ROSE CHAFFER—Its Form and Colour—Its Habits—The Larva and its Transformations—Its Cocoon—An Unexpected Discovery—The GNORIMUS—Its Habits—Humanity to Insects—The Mutual Rights of Man and Insects—Best Mode of killing Insects.

THE group of insects in the accompanying illustration is formed by a selection from some remarkably useful insects which are fortunately plentiful in this country, though their numbers are necessarily reduced in proportion to the spread and extent of civilization, and the ease with which refuse substances are subjected to the manufacturing powers of man.

The chief use of these insects is to remove from the earth the bodies of dead animals—a task which is most effectually performed. None, however, do their work in so satisfactory a manner as the BURYING BEETLE, two specimens of which are represented in the engraving, in order to exhibit its appearance as it traverses the ground and as it flies through the air. The large and powerful wings of this insect enable it to pass over a large extent of country, and are given in order to permit the creature to rove the country in search of the objects which are destined to supply nutriment not so much for itself as for its future young.

The instincts with which these Beetles are furnished are singularly keen and subtle, enabling them to distinguish dead animal matter at a wonderful distance. Nothing is easier than to catch a Burying Beetle. Lay a dead mouse, frog, bird, or fowl's head, upon some quiet spot in the garden, where the soil is soft, and you will often find that on the following day it will have nearly or quite disappeared beneath the ground. Take it up, and below it will be found the industrious and powerful insects which have entombed in so short a time so comparatively large an object.

To bury the largest elephant that ever lived would be to man a task proportionably lighter than to bury a mouse is to the beetle, and yet a couple of these insects will accomplish the deed in little more than a full day. The mode by which this act is performed is very simple, consisting in digging under the animal, and letting it sink gradually as the earth is removed from below it. In some cases the body will be sunken several inches below the surface of the ground.

When this portion of the duty has been performed, the eggs are deposited upon the buried carcass, and the parent insect works her way afresh to the outer air. In process of time the eggs are hatched, and from them proceed a number of long-bodied spindle-shaped grubs, notable for a large, spined, scaly plate on each ring of the body, which is supposed to aid them in pushing their way through the putrefying animal matter on which they feed. They are slow walkers, and indeed, being placed in the midst of abundance, and out of the reach of enemies, they do not require limbs, which would find no scope for exercise.

Sunken thus below the ground, they continue to feed until they have attained their full growth. They are then about an inch and a half in length. When the time for their change approaches, they make a sort of cell in the earth, and there lie until they have assumed their perfect form.

There are several species of Burying Beetles in England, the largest of which is nearly black, but most of the others are beautifully banded with bright orange, and are very conspicuous in consequence. Though beautiful in colour and elegant in form, they are not agreeable to the touch, as they have a habit of discharging from the mouth a blackish fluid of a most unpleasant odour, not in the least resembling that which is ejected by the cocktail beetle, but nearly as disagreeable, and, if possible, more permanent.

The benefits which are conferred by these wonderful insects cannot be overrated, for not only do they remove from the surface of the earth the objects which would exhale most pestilential odours if suffered to decay undisturbed, but they convey into the ground the very substances which are needed to supply the vegetation with nourishment, and thus play the double part of scavengers and gardeners.

It is impossible to watch the habits of this beetle without admiration at the wonderful manner in which the great work of creation is carried on, and the marvellous care with which the smallest details are carried out. Here, as in other cases, though perhaps in a more conspicuous manner, the dependence of life upon death is manifested, and the two great phases of nature—dissolution and reproduction—are brought into palpable connexion with each other. Birth implies death, and could not exist without its preliminary aid; and the same great principle pervades the whole of creation.

Sooner or later all material objects die, and are succeeded by new generations; and whether in the organic or inorganic kingdoms, this law reigns supreme and unchanging. The length of duration allotted to each being may vary—the fungus passes through its life-phase in a few hours, while the tree measures a span of a thousand years, and the pebble at its foot has endured through successive æons which man has not yet measured—but with Him from whom all created things proceed, space, and time, which is its offspring, exist not, and the short life of the mushroom is as important to the universe as the comparative eternity of the oak or the pebble.

The river dies into the sea, and its scattered waters are restored in rain and snow and nightly dew. The pebble yields, sooner or later, to the one great law: its form and substance is resolved into its constituent gases, which, in their turn, become concrete again into new forms. Throughout the whole of nature, this wondrous circle revolves, each end being the inevitable parent of a new beginning, and each beginning the prophecy of a coming end. The great poets of the ancient times had long seen this truth, and this is the meaning of their well-known fable, the phœnix rising with renewed youth from the ashes of its aged parent.

If the reader will turn to the illustration on page 152, he will see on its right hand a moderate-sized beetle with a flattish body.

This is another of the valued friends of the gardener and agriculturist, one of those which are fellow-workers with the burying beetles in their useful tasks. It is essentially a devourer of decaying animal substances, and may be found, in company with the burying beetle, on any carrion that may perchance be left in the open air.

Mole-catchers are very fond of advertising their prowess by hanging the slaughtered moles on willows and trees which afford slender and pliable twigs, which can be twisted round the bodies of the slain. The bodies of these suspended moles are mostly full of larvæ belonging to some species of this genus; and, as the outer skin of the dead mole is baked hard in the sun, the insects can be heard rattling inside, if the twig to which it is suspended be shaken. When they have passed through their full time of larvahood, they drop to the earth, bury themselves under the ground, and when they have assumed their adult shapes they emerge, and, in their turn, seek for similar homes for their future families.

Their value, in eating these dead bodies, can be best appreciated by those who live in a mole-frequented country, and are forced to pass to leeward of the trees whereon the dead animals are strung.

These cases are, however, of comparatively little value, and are mentioned only as being more conspicuous than the many unseen services which these little insects render to man. Moreover, some species are invaluable assistants in aiding him to keep down the numbers of various destructive insects.

Among these may be mentioned the FOUR-SPOT SILPHA (*Silpha quatuor-punctata*), an insect that is frequently mistaken for a ladybird. It is not unlike that pretty beetle, the body being rounded, and the colour a bright red-brown, with two large black spots on the back. It may, however, be at once known by its comparative length. This creature ascends oak-trees for the purpose of devouring the various caterpillars which make such havoc among the leafage; and another species (*Silpha lævigata*), known by its smooth wing-cases, attacks living snails, and, in spite of their greater size, destroys and eats them—I should rather say, eats and destroys them, the animal being nearly devoured before it can be reckoned among the dead.

The larvæ of the Silphidæ are flat, black, dull-looking grubs, wonderfully active, and very ready to escape. I may here mention that figures of the larvæ of the Silpha and many other beetles may be found on reference to the plates, even though engravings of the perfect insects may be given in the pages.

ON the left hand of the illustration is seen a curious little beetle, which is not easy to describe, but is readily recognisable by the engraving. It is remarkably hard, very black, and very polished, looking, indeed, as though it had been cut out of jet or black glass. The wing-cases are very short, and do not reach quite to the end of the body.

This is one of a large genus, the various species of which so closely resemble each other that they are with difficulty distinguished from each other. The name of MIMIC BEETLE is given to it because it simulates death when alarmed, drawing down its head, tucking in its legs, and doing its best to resemble a stray pebble or black seed fallen carelessly on the ground.

The larvæ feed on decaying animal and vegetable substances, and therefore perform services analogous to those which are rendered by the above-mentioned beetles. They are strangely shaped; and no one who was unacquainted with the history of the insect would conceive that they would, in process of time, be transformed into Mimic Beetles. The perfect insect is short, flattish, rounded, hard, black, and polished. The larva is long and worm-like, with six little legs, and a telescopic tube at the end of its tail; white, soft, and smooth.

All the Mimic Beetles are slow of foot, but they are tolerably swift and powerful in the air, possessing a pair of large and beautiful wings, which, when expanded, seem much too large to be packed under their short covers. None of them attain to any great size, the species shown in the illustration being one of the largest examples.

Cultivators of that remarkable esculent, the truffle, are much annoyed by the inroads of a little creature that devours the valuable plant. This is the TRUFFLE BEETLE (*Anisotoma cinnamonea*), a small insect that may be easily recognised by reference to the illustration. Its body is boldly rounded, and its colour is a pale chestnut, not unlike the peculiar tint of cinnamon bark, from which it has derived its scientific name. The curved hind legs afford a good sign by which the insect may be distinguished.

I know of no plan whereby the Truffle Beetle can be extirpated, but as it is very annoying to the enterprising gardeners who do not content themselves with the usual system, and endeavour to extend their field of usefulness, I have given a figure allow the rook, the blackbird, the sparrow and other of our winged allies, to dwell unmolested on our grounds.

They may certainly be turned to good account, for poultry are very fond of them, and thrive well upon the fat white grub or the perfect insect. Towards the end of spring, when the Cockchaffers come out from their three-years' entombment and take to wing with their heavy, blundering flight, the poultry hold great feastings, chasing the beetles as they run on the ground or jumping up and snapping at them as they fly along near the earth. Children may be advantageously employed to catch them, for it is an amusement to them to chase the insects, and then the poultry can be fed on the captives.

Even in this country, the Cockchaffer occurs in swarms, making even a walk in the fields unpleasant from the continual annoyance of these beetles flying against the face, or entangling themselves in the hair. On some evenings the hat and clothes will be covered with Cockchaffers, which come blundering along, strike themselves against any object which happens to be in the line of their flight, and then cling so tightly with their claws that they are with difficulty dislodged.

These swarming insects are quite as destructive to the trees as are their larvæ to the roots. They are insatiable devourers of leaves, and will strip whole copses as bare as if the frosts of winter had set in. On the Continent their numbers are far greater than in this country, the long and systematic bird persecution being doubtlessly responsible for much of the mischief. Some idea of their vast numbers may be formed from the fact that in a few days fourteen thousand of these insects were captured by children near Blois and other places; the farmers ceased to count the insects, but measured them and the grubs by the bushel.

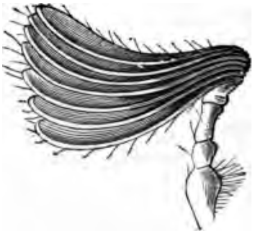
It is possible that the Cockchaffer may even yet be made beneficial to man, and that some useful quality may be discovered in it. At present, the only use to which these creatures seem to have been put is, to boil them down and collect the abundant fat which pours from their bodies, and which is employed for greasing the wheels of carriages, and for similar purposes.

Having now hastily glanced over the history of this destructive insect, our next business is to find out the best method of killing it. It cannot be denied that though the rooks and other birds which devour the larvæ of the Cockchaffer perform their task in a very effectual manner, they peck up the grass to such an extent as to render the lawn a very unsightly object. Nothing seems so fatal to these insects as alkali, which may be administered in various methods.

Cyanuses of various kinds are strongly recommended, but the simple solution of ammonia is as effectual as anything can be, and does not injure the vegetation. The solution should be weak, and it is better to wait for a wet day before employing it. If the weather has been hot and dry for any length of time, the thirsty soil drinks up the fatal liquid so fast, that very little of it finds its way down to the subterranean haunts of the insects.

The ammoniacal liquid that is obtained from gas-works is also useful in destroying these insects, and, where the extent of ground is very great, may be used with advantage. It is not, however, so pleasant or so cleanly as the solution which has just been mentioned, and, for an ordinary garden, I should certainly prefer the latter.

I may mention here that the shortest method of preparing the solution is to stir the ammonia into boiling water, and then add cold water until it has been sufficiently diluted. Care must be taken to perform this operation in the open air, and to keep well to the windward of the vessel in which the preparation is being conducted. The fumes that arise from the liquid are so copious and so pungent, that they affect the eyes, lungs, and nostrils, and afford a very sufficient reason for their fatal effects upon the insects.



ANTENNA OF COCKCHAFFER.

The male and female Cockchaffer may be readily distinguished by the shape of the antennæ, which are furnished with curious knobbed extremities, small in the female, but in the male modified into a most beautiful organ, composed of a series of long and flattened plates, which can be closed or opened like the sticks of a fan. A magnified representation of the antenna is here given, in order to show the wonderfully beautiful structure with which the Creator has endowed this insect. The bold and graceful curves are the admiration of every artist, and their effect while the fan is being gently opened and closed is peculiarly striking.

There is a smaller insect which greatly resembles the cockchaffer, and is often taken for a small specimen. This is the SUMMER CHAFFER (*Amphimalla solstitialis*), a beetle which appears, as its name denotes, in the summer months, after the great bulk of the cockchaffers have disappeared.

ANOTHER of our garden pests is the well-known GARDEN BEETLE, or BRACKEN CLOCK (*Phyllopertha horticola*), an insect which is unfortunately too plentiful in this country. Its form may at once be recognised by reference to the illustration, and its colour is as follows: The body and head are very dark green, and a little patch of the same colour is seen at the tips of the red antennæ. The wing-cases are reddish brown, and do not quite reach to the extremity of the body.

This little beetle is, like the cockchaffer, to which it is closely related, destructive both in its larval and perfect state. The eggs of the Bracken Clock are deposited in the earth at the latter end of July, and there are speedily hatched. From them proceed little grubs, which grow with surprising rapidity, and are very similar to those of the cockchaffer. Like those grubs, they remain below the ground until they are ready to undergo their last change, and feed voraciously on the roots of grasses and other plants. They are not so plentiful as the cockchaffer; their bodies are not so large, nor their jaws so powerful, but, in proportion to their size, they are quite as injurious to the vegetation.

About June and July, the perfect insect emerges from the earth, and then commences its attacks upon the trees and shrubs. It does much damage to roses, among the petals of which it may be often found, and is extremely injurious to fruit trees, devouring not only the leaves, but even the young and barely set fruit.

The leaves on which this beetle has been feeding are gnawed into holes, just as if some destructive acid had been sprinkled over them.

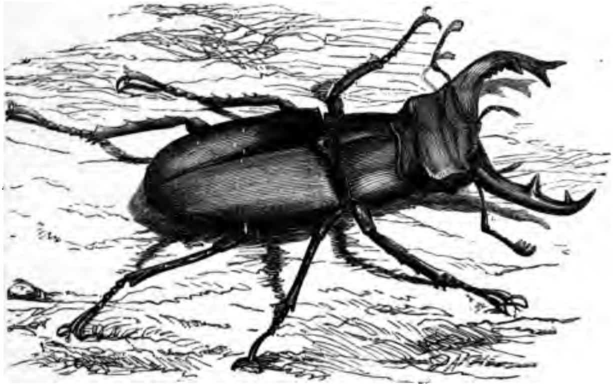
The grubs may be destroyed in the same manner as those of the cockchaffer, and the perfect insects may be found in the evening by means of a lantern. When they feel themselves discovered, they assume a most absurd attitude, and try to make the foe believe that they are dead. They crouch as low as they can, poke the two hind legs upwards, one on each side of the body, hold the two fore legs in front of the head, and press the middle pair of legs firmly downwards. In this curious attitude they will remain perfectly motionless for a very long time.

THE great STAG BEETLE is the largest of the British Coleoptera, and is so conspicuous an insect, that it can be recognised at a glance. In its perfect state, this fine beetle does little, if any, harm to the agriculturist, but in the larval condition it is extremely injurious to the trees.

The grub of this insect is something like that of the cockchaffer, but enormously large and fat, and with a most terrible pair of jaws. The larva is always much larger than the perfect insect, as any one may see who compares a full-grown caterpillar with a moth of the same species, a wasp-grub with the winged insect, and a cockchaffer-grub with the beetle itself. Therefore, the size of a full-grown Stag Beetle's larva may be easily imagined, the insect being drawn of the natural dimensions. By many persons this grub is thought to be the celebrated "cossus" or "cossis" of the ancients, a large worm bred in the trunks of trees, which was considered a delicacy by classical epicures.

In Kent, the Stag Beetle is very plentiful, and, in consequence, its larva may be found with tolerable ease. One of those larvæ now before me, and which was taken close to my house, is a truly formidable being, with a large horny rounded head, that looks as impenetrable as a tilter's helmet, and a pair of long, black, horny jaws, that seem as if they could make their way through the hardest wood without the least trouble.

The horny envelope of the head being nearly transparent, the mechanism of the jaws is beautifully seen, as they move backwards and forwards, with a quiet power, that irresistibly reminds the observer of the steam shears used to cut iron plates and other trifles in dockyards and engine-makers' establishments. So strong are those weapons, and so sharp are their edges, that though I am not afraid of any insect, I have been very careful in keeping my fingers out of their grasp.



STAG BEETLE.—*Lucanus cervus.*

This grub lives within the trunks of trees, which it gnaws with its powerful jaws, and on account of its great size and voracious appetite is really a destructive creature, the wood which it has eaten being reduced to a mass of chips that look very like tan after it has been removed from the pits. It remains within the tree for a very long space of time, certainly for three years, and, according to some authors, for double that time, boring its large tunnels into all parts of the trunk, and even into the roots of the tree.

When the time arrives for it to rest from its devouring labours, and to undergo its change into the perfect form, it makes a kind of cocoon from chips of wood, and there lies secure until it has attained its perfect condition. The great jaws with which this beetle is armed belong only to the male, the female resembling her mate in the form of body and limbs, but having a pair of short, thick, and sharp jaws, instead of the huge weapons of the male. With these jaws, the Stag Beetle can inflict a very painful pinch, as I can testify from personal experience; but, in spite of the greater size and more formidable aspect of the male beetle's jaws, I would rather trust my finger within their grasp, than permit the smaller, but sharper jaws of the female to exert their powers on me.

Many entomologists think that these peculiarly trenchant jaws are given to the female beetle in order to enable her to penetrate the tree trunks, and therein to make a burrow in which her eggs can be placed. This supposition is certainly a rational one, and is corroborated by the fact that the jaws of the female bear a close resemblance to those of the larva.

When the male beetle undergoes transformation, its head is bent downwards, so that the huge jaws lie flatly on the under side of the thorax, and cause no inconvenience. A similar mode of disposing of over large and projecting organs may be seen in other insects. The great sphinx moths, for example, have their long proboscis packed neatly into a supplementary case, which proceeds from the head. The trunk of the butterfly lies straight along the lower surface of the whole body, taking no curl, until the insect has escaped from its pupal armour, and the wonderfully long antennæ of the long-horned moth are rolled spirally round the end of the abdomen.

The Stag Beetle readily becomes domesticated and learns to know its owner, and is a playful and amusing insect. I have kept many of them, and have spent many a pleasant hour in watching their interesting ways.

As to the best method of destroying this insect, I know none better than searching for the female, and killing her when found. These insects are rather chary of leaving the spot where they were bred, and may be seen clinging to the trunk of the very tree in which they had passed their preliminary states of existence. The willow and the oak seem to be the trees that suffer most from the ravages of the Stag Beetle.

As every creature has its synonyms in different parts of the country, I may here mention, that in Kent, and in many districts, the Stag Beetle is popularly known by the name of the Horn-bug.

THE well-known ROSE BEETLE, or ROSE CHAFFER, is a truly beautiful insect, and to all appearance is as innocent as it is lovely. But if, according to the venerable proverb, handsome is that handsome does, we must consider the Rose Beetle as a very ugly insect.

The shape of this beetle is very well shown in the illustration, and its colour is rich shining green above, with a few small markings of white, and fiery coppery-red below.

This insect is mostly found buried in the very centre of roses, and does no inconsiderable damage to these beautiful flowers, eating part of the nectary and the thick lower portion of the petals. It also devours those portions of the flower where the sweet juices are to be found, and does not restrict itself solely to the rose, though it certainly prefers that flower to all other plants cultivated in our gardens. The sweet fragrant elder-flowers are also haunted by this beetle, as are also those of the candy tuft and mountain ash. Even the strawberry does not escape its attacks, but yields the life of the future fruit to this beautiful but annoying insect.

The wings of the Rose Beetle are peculiarly long and spreading, and, when fully extended, give to the insect a remarkably bold and handsome appearance. The flight is strong, swift, and more under the command of the insect than is that of the cockchaffer and dor beetle, and instead of selecting the evening for its flight, as is the case with those beetles, it prefers the hottest part of the day for its travels, flying along with a dull, humming kind of a buzz, quite different from the heavy drone of the dor beetle. While flying it has a very beautiful appearance, the sun's rays glancing from its polished surface, and its metallic sheen glittering in all the glory of its brilliant hues.

This insect is very liable to the attacks of that unpleasant-looking mite which swarms so thickly upon the common dor beetle, and clings so tightly to the under surface of its body.

The larva of this beetle is not so injurious as that of the cockchaffer, though it bears a great resemblance to that creature, as may be seen by reference to the illustration. It is greyish white in colour, and the enlarged portion at the end of the body has a tolerably high polish. It always resides in some dark locality, sometimes in decaying wood, and sometimes, according to Kirby, in the nests of ants, and derives therefrom the popular title of King of the Ants.

It remains in the larval state about three years, and then makes for itself a cocoon wherein to pass the few months of its inactivity. This temporary dwelling-place is about an inch in length, and is very strongly built of wood-chips cemented together, and of an oval shape: indeed, it looks something like the egg of a sparrow or other small bird which has become very dirty, and covered with mud and sawdust. In a favourable locality these cocoons may be found in profusion. Mr. F. Smith tells me that a gentleman of his acquaintance came one day across the decayed stump of an old tree, and gave it a rather hard kick to try its strength. The soft and feeble wood gave way under the blow, broke asunder, and with the decaying mass fell a vast number of these cocoons, certainly not less than a hundred, and probably more. The cocoon is formed in a similar manner even when made in the ants' nest, and it is probable that the larva feeds on the chips of wood which the ants use so lavishly in building their dwelling. Sometimes the egg of this insect is laid in the ground, and in that case the grub feeds on whatever vegetable substances it can obtain, and, being destructive to vegetation, may fall a victim to the same fatal solution which destroys the larvæ of the cockchaffer.

There is an insect which greatly resembles the rose beetle, and is popularly called by the same title. It may, however, be distinguished from that insect by the shape of the wing-cases, which are not waved at the sides like those of the rose beetle. The scientific name of this beetle is *Gnorimus nobilis.*

It is thought to be rather a rare insect, but its rarity depends greatly on the manner in which it passes its life. It lives chiefly in the decaying wood of hollow trees, and aids in extending the process of destruction. Apple-trees seem to be especially favoured by this beetle, and I am told that in some decaying apple-trees at Hammersmith both the larvæ and perfect insect may be captured in plenty.

These, as well as many other beautiful insects, are best attacked by capturing the adults and killing them. Though we have a perfect right to kill the creatures whenever their life interferes with our welfare, it must still be remembered that we have no right to inflict upon them any pain that can be avoided; therefore, I trust that every reader of this book will pause before he takes the life of any creature, and, having decided that it ought to be killed, that he will destroy it as mercifully and quickly as can be accomplished.

Let him not fling the beetle down, tread on it, and go his way carelessly, for the life clings tightly to the frame, and the unfortunate creature may linger in pain for hours after receiving a mortal injury. I know that the dying beetle and the dying giant do not suffer equal agonies if crushed, but we have no right to inflict any agony that we can by any exertion of forethought avoid.

It may be said that one insect preys upon another, and that in so doing it inflicts infinitely more pain than we should do by partially crushing it, and leaving it to die. I do not know that such is really the case. It is very true that we, with our human feelings and different instincts, would suffer infinitely more pain by being slowly eaten by some sharp-toothed creature than if we were half-crushed by some heavy weight; but it does not follow that such is the case with the insects. The one mode of death is according to the system of nature, the other is opposed to it; and we may be assured that the kind and merciful Creator of the universe has framed His laws so as to give every being as much happiness and as little pain as is compatible with its nature.

The Beetles and many other insects, especially those of larger size, are so tenacious of life that they will live for a very long time after being crushed out of all shape, and demand at our hands some more speedy death. Strange as the assertion may appear to some of my readers, there is no more merciful death for beetles than immersion in boiling water. The contact of the boiling fluid is instantaneously fatal; the insects have not even time to struggle, and they pass from life to death as if struck by lightning.

But in order to carry out this operation rightly the water must be *boiling.* Hot water, according to the common acceptation of the term, affords but a cruel and lingering death. The proper way to kill these creatures is to place them in a jar, to bring the jar near the kettle, and to pour the water on them, hissing and spattering as it is taken from the fire. Or the boiling water may be poured into a vessel, and the beetles thrown into it. They should not be merely dropped, but dashed into the water, so as to cause instantaneous death.

Even after this rough process the beetles may be preserved for the cabinet, if the gardener is anything of an entomologist, but the moths will be ruined and useless for any such purpose. Still, it is by far the most effectual method of killing them, especially the fat, large-bodied moths, which most assuredly possess the fabled lives of twenty cats, and are so tenacious of life that while one portion of their body is dead and dry, so that it will snap off when bent, another part will retain its nervous energy, and move about when touched.

If the gardener should desire to preserve any of these creatures for the cabinet, there is a neater method, but one which takes up some little time. It has already been described in my "Common Objects of the Country," and, as its repetition would occupy some little space, need not be again described in this work.

CHAPTER X.

The WIREWORM and its Parent—Remarkable Powers of the Beetle—Mode of Flight—Ravages of the Wireworm—Methods of destroying it—Starving the Wireworm out—Efficacy of Alkalies—Feathered Enemies—The GLOWWORM and its Qualities—Its Food—Services which it renders—Its Larva and Singular Cleansing Apparatus—The DRILUS—Contrast of the Sexes—The Larva and its Food—Its curious Habits and Services to the Gardener—The RASPBERRY BEETLE—Its Shape and Colour—The Larva and its Food—Its Ravages—Difficulty of destroying it—The MUSHROOM BEETLE—Fungi and their Qualities—Larva of the Beetle—Its Habits—The BLISTER BEETLE, or SPANISH FLY—Its Qualities and Habits—The OIL BEETLE—Its Habits and Uses.

THE very name of the WIREWORM is enough to make the heart of the agriculturist sink within him. The farmer sees in that word the name of one of his worst foes, of an enemy which is ever ready to attack, and only too successful in its destructive campaign. Whole fields of wheat, oats, and turnips fade away under the withering presence of this dread insect; the seed, the labour, and the time, are all wasted; and the unfortunate agriculturist is only too glad if a second ploughing and sowing may be more successful than the former.

There are several creatures that are called Wireworms, and the two most destructive and most plentiful have been selected for illustration. They are all the larvæ of certain beetles, very common, and very familiar under the names of SKIPJACKS, SPRING BEETLES, or CLICK BEETLES, on account of a curious habit which they possess.

Their legs are very short, and, when they are laid on their backs, they would be quite unable to recover their position but for a very curious apparatus with which they are furnished. This consists of a stiff elastic spine that projects backward from the central part of that portion of the insect which is technically called the prosternum, and fits into a notch just in front of the base of the middle legs, thus forming an apparatus precisely like the spring and notch of the toy skipjack.

When, therefore, the beetle finds itself lying on its back, it wastes no time in struggling, but folds its antennæ into grooves made for their reception, presses its legs against its body, and prepares for a jump. It then bends itself backwards, so that it is only supported by the end of the abdomen and the head. During this movement, the spine is thrown out of its groove, but, on the pressure being removed, it flies back to its place, the body of the insect is violently struck against the ground, and the beetle is flung into the air to some little height. A peculiar "click" is heard at the moment of leaping, and has earned for these insects the name of Click Beetles.

It does not always fall on its feet, but sometimes tumbles over on its back again, and is obliged to repeat the process until it is successful. It is a persevering creature, and will jump eight or ten times in rapid succession, but will then, if unsuccessful, lie still for some time, as if to rest itself after its labours.

We may naturally ask ourselves why this insect in particular is gifted with so remarkable a power, when there are many other beetles that have round backs, short legs, and might stand in need of similar assistance. The fact is, that these beetles are for ever falling down. They may be seen crawling up the grass stems, or clinging to the leaves of plants, and, as soon as they see the advancing intruder, they loosen their hold, drop to the ground, and there lie in perfect stillness until they fancy that the danger has passed away. When they have thus fallen, a very quick eye is required for their detection, as they are mostly dull-coloured, and perfectly inconspicuous.

They are furnished with wide and powerful wings, and can fly with some speed; their flight is mostly low, and they have a custom of making for some particular spot, and just as you are looking for them to settle they disappear. This phenomenon is achieved in a very simple manner. The beetle flies downwards, making a circular kind of sweep as it descends, and, instead of alighting on the spot towards which its course has been directed, it suddenly settles on a projecting grass stalk, furls its wings instantaneously, and there clings motionless, its body on a line with the stalk. Owing to the length of the wing-cases, the wings need but little folding; a tiny flounce projects at the end of the body for a moment or two, but is speedily withdrawn, and with a kind of a shake, as if to settle everything in its place, the insect becomes quite motionless. When flying, the wing-cases are thrown more forward than is the general custom among beetles.

Owing to their ready wings, they cannot be excluded from our gardens, though their numbers may be thinned by killing every perfect insect that can be captured. The general appearance of these beetles can be easily learned from the figures; and as the colours of the species are for the most part very similar, and their larvæ are either wholly or for the most part obnoxious to the agriculturist, the safest plan is to destroy any Skipjack Beetle which we may meet.

The most destructive of all these creatures seems by common consent to be the insect that is scientifically termed *Cataphagus lineatus*, or, in some works, *Elater lineatus.* The former title is certainly the more appropriate of the two; the generic name, *Cataphagus*, or omnivorous, being highly characteristic of its destructive powers, and the word *lineatus* being expressive of the raised lines which are drawn along its wing-cases. In my own collection are examples of nearly every British species of Skipjack Beetle, set so as to represent them in their ordinary attitudes of walking or flying. The species under consideration may be identified by its reddish wing-cases, with their many longitudinal furrows, and dull black head and thorax.

These beetles are quite harmless in their perfect state, and might still remain unmolested, were it not for their insatiable voracity in the larval condition. The mother deposits its eggs in a favourable locality, and then leaves them. Immediately on entering upon their individual existence, the young grubs commence their destructive habits. They eat indefatigably, until they literally burst their skins; and then they throw off the insufficient garment, expand their bodies, and eat with redoubled vigour.

Being for the most part shy and retiring in their habits, and living just below the surface of the ground, their presence is generally indicated merely by the mischief which they have done. The corn blades begin to droop, they turn yellow, and then they die. Turnips are affected in a similar manner. Lettuces perish for want of nourishment, for the Wireworm eats through the plant just at the point where the leaves take their rise, and so cuts off the supply of nutriment.

They are very strong and hardy creatures, and can scarcely be killed by violence. All kinds of remedies have been tried. Heavy rollers have been drawn over the ground; but the hard, tough skin of the Wireworm is proof against such trifling attacks. It is true, that if a man were laid on the ground, and the dome of St. Paul's rolled over him, he might suffer considerable injury; but the Wireworm has a stronger constitution, and when the roller passes over it, the tough-skinned creature is merely pressed into the earth, and emerges again, nothing the worse for the adventure. In fact, the name of Wireworm is given to these larvæ because their skins are so hard and tough that they appear almost as if made of animated wire.

Burying the Wireworm under shovels full of earth has been tried; but that mode of destruction is very much analogous to the experiment of drowning a fish. Shaking the grubs off the leaves by ropes is a favourite plan with some farmers, but is slightly futile in its operation, as the greater part of the grubs are below the soil, and those that are on the leaves, and are shaken off, have nothing to do but climb up again.

Drowning them has been attempted by agriculturists whose lands lie low; but as the Wireworm can endure three or four days' immersion without being in the least troubled, that plan is useless. Drowning the land has, however, been recommended as a precaution just about the time when the insects deposit their eggs, because the beetles are unable to find convenient spots for the reception of the eggs, and so the next generation of Wireworms is nipped in the bud.

Contrary to the general rule among insects, the female excites greater admiration than her mate, her luminous power being very superior to that which is possessed by the male. Many persons think that the female alone is luminous, but that opinion may be refuted by any one who captures a male Glowworm and keeps it alive. I have had many of these insects, and have always found that the luminosity of the male was a matter of surprise to those who saw the insect.

The luminous portion of the Glowworm is situated at the end of the tail, and in the healthy female it is sufficiently powerful to throw out a radiance which illuminates the leaves for an inch or two around it. It is generally seen upon the grass, but I have often found it upon nettles in the hedge side, and in that position the light has a peculiarly beautiful effect as it shines through the green leaves. Sometimes the creature will extinguish its lamp without the slightest apparent cause, and will again blaze out with renewed splendour.

The substance that produces this light is supposed to be of a phosphorescent nature, though the fact that it does not become more intense in oxygen gas seems rather to militate against that hypothesis.

The female is without wings, and would hardly be taken for a beetle by one who was not skilled in entomology. It is long, brown, soft, and flattish, and is very slow in its movements and disinclined to stir, remaining for days together in the same spot.

The male, on the contrary, is a well-developed beetle, with very long wing-cases and broad wings. The head is very small, and sunk under the thorax, and the eyes are enormously large in proportion to the head. Like the female, it is luminous, but the light is restricted to a pair of bright round spots at the end of the tail, which gleam at night just as if two pins' heads were heated to a white glow. Even when the insect is killed, the luminosity does not disappear together with the life, but fades slowly away, not so much paling in intensity as diminishing in volume. The larva, the pupa, and even the eggs, partake, though slightly, of this luminous quality.

Both in the perfect and preliminary stages of existence, the Glowworm is eminently useful to the gardener; and if he could procure a few hundreds of these beautiful insects and place them in different parts of his garden, he would confer a benefit upon himself, while at the same time he added much to the nightly beauty of his domains.

The Glowworm feeds upon snails, especially preferring those of the genus *Zonites* or *Helicella.* The larva is furnished with a very remarkable apparatus at the end of its tail, which serves for clearing the body of the slime which exudes from the murdered snails. This apparatus had long ago been observed, but its only recognised use was to act as an aid to locomotion. In the "*Bulletin Soc. Phil.*" in Feb. 1826, is a careful account of this larva, in which the true object of this tuft is described. It consists of seven or eight whitish filaments radiating from a common point, and looking something like a small brush. After the larva has gorged itself upon the body of its prey, it turns its tail over its back, protrudes the filamentous tuft, and so cleanses the head and thorax, which are necessarily covered with slime.

The eggs of the Glowworm are very large, and of a yellowish colour. They are deposited upon certain plants, to which they are cemented by a peculiar secretion, or sometimes are buried in the earth.

ANOTHER most useful insect, which belongs to the same family as the glowworm, is the *Drilus flavescens.* I know of no popular name for this beetle. It is rather a pretty creature, its shape being elegant and its colours pleasing. The colour of the male is deep black upon the thorax, and yellowish brown upon the wing-cases. The antennæ are peculiarly handsome, being deeply fringed like the tooth of a comb, and when fully extended are beautiful objects for the microscope.

The female is even more unlike her mate than is the case with the glowworm. She is quite wingless, and is long, flattish, and soft-bodied. The head is very small indeed, and the body increases regularly in width from the head nearly to the tail. Her antennæ are quite destitute of the beautiful comb-like form which distinguishes those of the male, and her colour is tawny. Altogether, she and her mate are so utterly dissimilar, that for many years the two sexes were ticketed in cabinets and described in books as two distinct species. The female is very similar in form to the larva, even in the fact that the three segments of which the thorax is formed in the larva remain separate throughout her entire life.

On reference to the plates, the reader will find a figure of the larva, which is a truly remarkable creature. It is larger than would be imagined from the size of the perfect insect, very wide, very flat, pointed towards the head, and carrying a kind of fork at the end of the tail. This appendage is used for locomotion, and is peculiarly useful when employed in pushing the creature into the shells of the snails. Its colour is pale orange-brown, but it has at first sight a darker look, owing to the tufts of deep brown hair which are profusely scattered over the upper surface. On the under surface are a great number of false legs, by means of which the creature is enabled to force its way into the homes of its unwilling victims.

This larva is not seen very often, though it is far from rare, because, when it has fixed upon a snail, and pushed its way into the shell, it remains in that situation, eats and grows there. There also it changes its coat as is the manner of insect larvæ, and it is a notable fact that the cast skins exactly fill up the entrance of the shell.

Small as is the head of this larva, it is furnished with a pair of most formidable jaws, thick, toothed, and powerful, and well calculated to tear up the soft body of the snail. The garden snail, *Helix nemoralis*, is the species which is generally slaughtered by this remarkable insect. The great difference in size of the male and female is really remarkable, and has been aptly compared to that between a hare and a cow. The male is only a quarter of an inch in length, and rather round bodied, while the female is three-quarters of an inch long, wide, and fleshy. The union of these insects irresistibly reminds the observer of Count Borolawski and his wife.

The reader will, perhaps, be pleased to know that all the figures of insects in this work are drawn from actual examples—if possible, from the living specimens; and if not, from the insects in the collection at the British Museum. The larvæ are also, wherever practicable, taken from the same sources.

GARDENERS, or, at all events, those who eat the fruit of the gardens, are always annoyed when they come to the delicately-flavoured raspberry, by finding one or more white, fat, helpless grubs in the midst of the fruit, either remaining upon the stalk when the fruit is removed or lying in the hollow of the raspberry itself.

This is the larva of a very common little insect, called the RASPBERRY BEETLE (*Byturus tomentosus*), which may be recognised by the figure upon the plate. In colour it is dull yellowish brown, and may be found plentifully, reposing in the corolla of various flowers. Even in the perfect state it is injurious to the gardener, for, according to Kirby and Spence, it eats through the footstalk of the raspberry-flower, and has sometimes destroyed the entire crop.

The larva is rather long in proportion to its width, and is furnished with a pair of very small, but sharp and strong jaws, which enable it to eat the soft substances on which it feeds. It is cylindrical in form, but slightly flattened towards the head. On the tip of the abdomen are two curved points directed upwards, and slightly darker than the body of the insect, and below is a little cylindrical projection that serves the purpose of a foot.

There seems to be no mode of destroying this grub without removing the fruit from the tree, and therefore the best method of keeping down its numbers is to destroy the insects whenever they are seen.

June and July are the two months when the larva is most mischievous. Entomologists seem to be rather perplexed with this insect, as it presents several peculiarities of structure which disagree with any established family, and, in spite of its small dimensions, it has caused much trouble to those who study systematic entomology.

THE little insect we are now about to examine is placed by recent entomologists in a family of small extent, and which in this country is mostly represented by species of small size. Exotic species are, however, of considerable dimensions, and are upwards of an inch in length, their larvæ being therefore very destructive to the substances on which they feed. They are all boring beetles, some preferring hard and others choosing soft substances, and, as a general rule, are not plentiful in this country, the species which we shall now describe being the most common.

We are now beginning to learn the value of many productions of nature which had long lain in obscurity, and to find that, by our own stupid and ignorant prejudices, we have shut out many sources of food which were open to us. This pleasant island of ours is filled with nutritious and pleasant nutriment, and it is not too much to say that the tithe of its blessings are not yet known to man. Even in the native and uncared-for wildness of our rivers, woods, and plains, we have uncounted treasures of valuable food, and in many cases the want of the cultivator's careful hand is the only obstacle to progress and plenty.

There are the fungi, for example—some of them are, as we well know, highly poisonous in their nature, and cannot be eaten without fatal or, at all events, painful results; yet the poisonous fungi form but a small percentage of the tribe, and man allows to perish annually an amount of nutriment which might maintain many a starving family.

We are too apt to leap at conclusions. Seeing that several fungi are poisonous, we pass at once into the illogical error of deducing the whole from the part, and straightway condemn the whole of the fungi, with one single exception, as poisonous; and yet these strange and wonderful productions of nature are well worth our care. The reader would be rather surprised if I were to enumerate and describe the many fungi that are most valuable as food, but which we condemn as poisonous, or despise as uneatable.

Fungi contain a very large amount of the very same constituents that give to animal substances their peculiar value; and therefore you will find that your vegetarian is a notable consumer of these edibles. One of my friends, an enthusiastic vegetarian, is ever on the look out for fungi—instinct thus supplying the place of reason, the latter condemning animal food, and the former acknowledging its necessity. His eyes are continually on the watch for fungi, and nothing can restrain him from gathering the objects of his desire. The almost universal predilection for the mushroom is more than mere desire for the gratification of the palate—it is a natural instinct that induces man to demand nitrogenous food.

Almost every one is pleased when he finds a mushroom in the field, with its smooth white spreading top, its pink laminæ below, and its peculiar and delicious fragrance. Clearly, there are few things more annoying than, when the mushroom is cooked, to find both the stem and the top filled with little white maggots, that cause infinite disgust and render the fungus quite unfit for consumption.

These maggots are the larvæ of the MUSHROOM BEETLE (*Cis boleti*), a little insect that may be found by hundreds, as it lives in many kinds of fungus besides the edible mushroom. It is a little, dull-looking beetle, extremely variable both in size and colour. Some of the specimens are twice as large as others, and, as a general fact, the females are the larger. The colour is also variable—sometimes being dark brown, approaching to black; sometimes pale brown, and not unfrequently taking a yellow hue. Much of this changeable character is attributable to the time which has elapsed since the beetle emerged from its pupal condition. When first it makes its escape, it is nearly white, and rather soft, but darkens and hardens by exposure to the light and air.

The larva of this beetle is quite white, very small, and of rather a peculiar shape, having a curve in its body that makes it recognisable even at a glance. The last ring of the body is armed with a pair of curved barbs, having their points directed towards the head.

THE very odd-looking beetle which is appropriately called the *Ripiphorus paradoxus*, in allusion to its remarkable shape, is one of the oddest looking of our British Coleoptera. As may be seen in the illustration, the antennæ of the male beetle are most beautiful in shape, resembling a pair of feathers rather than the antennæ of a beetle. They are even handsomer than those of the Drilus, inasmuch as the feathering is double instead of single. The generic name, *Ripiphorus*, is derived from two Greek words, and signifies fan-bearer. It is given to the insect because the antennæ are something like a lady's fan. Its legs are very long, and the thigh-joint is short and stout.

The female is not nearly so handsome as the male; her antennæ do not possess the beautiful feathering, and the wings are not so bold.

This insect may be reckoned among our Garden Friends, because it is parasitic in the nests of wasps, where it certainly intercepts the nourishment intended for the young brood, even if it does not destroy them, in order to feed upon them. The female beetle evidently lays her eggs in the cells of the wasps, and in order to enable her to perform this duty the abdomen is long and pointed. The late Rev. F. C. Hope mentioned a very curious circumstance, namely, that the large specimens of this insect, which are much rarer than the smaller examples, are found only in the cells of the female wasps.

BLISTER BEETLE.—*Cantharis vesicatória.*

In the above illustration may be seen a beetle which is extremely useful in the hospital, and extremely mischievous in the garden.

This is the celebrated **Blister Beetle**, sometimes called the

SPANISH FLY (*Cantharis vesicatoria*). The irritant effect of the secretions of this insect are well known, the blisters of the druggists being made of the powdered bodies of the Spanish Fly, mixed with other substances, in order to enable the compound to be spread on leather.

It is called the Spanish Fly, because it was first imported from Spain, where, indeed, our principal supplies are obtained. It is, however, of frequent occurrence throughout the warmer parts of the Continent; and though it is a very local insect in England, it is sometimes found in great quantities in certain spots. Those who capture and prepare the insect for the market are obliged to use sundry precautions; for the odorous particles which are emitted during the process are extremely injurious, especially if they attack the eyes or nostrils.

It is a beautiful insect, being of a rich green colour with a satin-like gloss and a golden refulgence, when seen in a cross light.

This is one of our garden foes, frequenting the privet, syringa, lilac, and ash, but especially haunting the last-mentioned tree. In some parts of England, when it has taken up its residence, it does very great damage to the ash, ruining the twigs and young leaves, and injuring the growth of the tree.

COMMON in our lanes and hedgerows is an allied species, the well-known **OIL BEETLE**, sometimes mixed by dishonest traders with the genuine blister beetle, to which it bears, when dried, some resemblance, both in colour and form, wanting, however, the rich sheen of the one and the elegant contour of the other.

These beetles are very strange beings, for when they are touched or alarmed a drop of yellow oil issues from the joints of the legs, a phenomenon which has earned for them their popular and appropriate title. They have no wings, but the wing-cases are tolerably large, those of the male reaching nearly to the extremity of the abdomen, while those of the female are short, and scarcely reach one-third of the distance.

The oil which exudes from the joints is thought, in many parts of England, to be a valuable medicine in cases of rheumatism, and is administered by being rubbed on the affected joints. In some parts of the Continent, the Oil Beetle is employed for the same purposes as the blister fly. The colour of this insect is deep indigo blue. As far as is yet known, it does but little harm in the garden.

CHAPTER XI.

WEEVILS—Their Beauty and General Characteristics—Pea Weevil—Form of its Jaws—Its Larva, and Habits of the Beetle—Bean Weevil—Form and Colour—Habits—Proposed Method of destroying it—Furze Weevil—Its Habits and Destructiveness—Apple Weevil—Destructiveness among the Flowers—Small Birds *versus* Weevils—Habits of the Insects—Best Mode of killing them—The ANTHRIBUS—Its Value to the Gardener, and singular Habits—Hazel Weevil—Its Destructiveness—Its Habits—Leaf-rolling—The Stem-borer and its Habits—Beak of the Weevil—Best Mode of destroying the Beetle—The Copper Weevil—A strange Cradle—Instinct and its Development—How to repel wingless Insects from Trees.

THE enormous group of insects which we shall now briefly examine are popularly known by the name of WEEVILS. All these beetles may be known by the long snout into which the front of the head is produced, the mouth being at the end of the snout or beak. The antennæ are elbowed, *i. e.* they are bent at right angles, and are set on the sides of the beak.

In England, none of these beetles attain large dimensions; but in the tropical climates many species are of large size, and often are clothed with a panoply of gems, such as even the fertile mind of the poet never conceived. The celebrated Diamond Beetle belongs to this group of insects; and we have, in England, many of the smaller species, which, when placed under a good microscope and properly illuminated, show that they are truly clad in vestures far excelling those worn by Solomon in all his glory.

No pencil can depict, and no pen describe, the wondrous glories with which these apparently insignificant creatures are clothed. We see them on the grass, crawling over the leaves of trees, or, perchance, settling on our tables, and we see nothing in them; but, when the microscope has played its part—has given to the eye, as it were, a new world of vision—and has disclosed the hidden wonders of nature, the most imperturbable mind cannot but be moved at the sight that is displayed.

There are few microscopic objects which strike a novice with more wonder than the wing-case of one of our common dull-green Weevils. He scarcely can believe his eyes. The dull green has vanished, and in its place he sees a shield set with diamonds, rubies, emeralds, and sapphires, interspersed with golden topaz, and flashing as if made of living light, too brilliant for the eye to endure for any long period.

Beautiful as are these beetles, they are terribly destructive; and there is hardly a tree or a shrub, or a herb or a flower, that does not suffer from the depredations of some Weevil, either in the larval or perfect condition, or perhaps in both.

Many species are without wings; and they are all rather slow in their movements. Some eat the bark of trees, while others prefer the buds and leaves. The larva is very unlike the perfect insect, and is always white and fleshy, without any real legs, but with a number of tubercles on the under surface, which act as false legs. The body is very soft, but the head is hard, horny, and carries a pair of strong and trenchant jaws, the action of which is very like that of the surgeon's "bone forceps."

The first of these insects in our list is the PEA WEEVIL (*Bruchus pisi*), a tiny, but potent insect, that often causes considerable annoyance, and sometimes has destroyed a whole crop, so that the only remedy has been to pull up the peas and burn them, in order to destroy all the beetles and their grubs. The form of this insect may be seen in the illustration. Its colour is brown.

The larva of the Pea Weevil is that little white grub, so familiar to those who shell peas, as it pokes its black head and fat white body out of the pea in which it has been residing, astonished at the sudden light. One of these larvæ will consume the whole interior of the pea, and leave merely a thin pellicle through which the perfect insect can force its way without difficulty. As this insect is found in vast swarms in North America, destroying whole crops at a time, it is thought by many entomologists to have been imported into this country from abroad.

The perfect insect may be found on flowers, and should always be destroyed whenever seen.

There is another little Weevil which also attacks the pea, but does not restrict itself to that vegetable, being equally injurious to beans.

This creature, which by way of distinction may be called the **Bean Weevil** (*Bruchus seminarius* or *granarius*), is rather a prettier species than that which has just been mentioned, the wing-covers being deep black, dotted profusely with white. As the creature is so small, the only effect upon the unaided eye is to produce a dull grey tint; but when the beetle is placed under the magnifying-glass its true colours are easily ascertained.

It is a very tiny creature, barely the tenth of an inch in length, but it is terribly destructive, and even continues to thrive after the peas and beans have been ripened and stored. A good suggestion has been offered for the purpose of killing the insect without damaging the fructifying power of the seed, namely, to place the peas before storing them in an oven heated to 150° Fahr. or thereabouts, which it is thought might destroy the insect without injuring the seed. For my own part, I rather doubt whether that heat would be effectual in its object, and fancy that an amount of heat which will destroy the beetle or its larva would be equally efficacious in killing the seed.

The female beetle acts with remarkable ingenuity while depositing her eggs. Traversing the surface of the pod during its early growth, when the walls are thin and their substance tender, she bores a little hole over each seed, and places one egg in each hole. Many of these eggs fail, but others are duly hatched, much to the annoyance of the gardener.

The perfect insect is a great frequenter of flowers, and even in the very earliest spring may be seen in the few flowers that bloom in that season. The golden blossoms of the furze are favourite haunts, and in the middle of summer it may be seen resting upon the flowers of the whitethorn.

This beetle, however, must not be confounded with the FURZE WEEVIL (*Bruchus villosus*), which lays its eggs in the seeds of that plant. It is much larger than the preceding species, and different in colour, its wing-cases being black, marked with lines and dots of whitish grey. The beetle may be seen in February busily depositing its eggs in the young and tender seed vessels that are the produce of the winter flowers, and in the middle of summer they may again be seen at work on the second series of pods.

I admit this beetle among the garden friends and foes because many persons, myself among the number, are very fond of the golden-blossomed furze as a garden shrub. and prize it for its rich beauty at a time of year when almost all other blossoms have faded away. In my opinion, there are few handsomer additions to a garden than a clump of fine healthy furze bushes, covered with their yellow flowers, and exhaling the sweet but peculiar fragrance which belongs to that plant alone.

The damage done to the furze by this beetle is very great, the whole of the seeds being eaten away by the larva and their place filled by a mass of black dust.

As the reader will doubtlessly have observed on reference to the illustrations, the larvæ of all these beetles bear a close resemblance to each other. As a general rule, the larvæ remain in their imperfect stage of existence until the following spring; but if the summer should be a peculiarly hot one, the progress of the insect is hastened, and the beetle makes its appearance in the autumn of the same year.

Only one genus of this family is found in England, and it is very probable that the greater number of the species, if not all of them, have been imported into this country together with corn, peas, and beans. By a very wonderful instinct, the larvæ of these beetles always leave the germinating portion of the seed until they have nearly completed the first stage of existence, so that they are supplied with nourishment during the whole of their larval condition.

The exotic species are comparatively numerous, and there seems to be hardly a plant that is not attacked by one or other of these little beetles. Even the cocoanut, though defended by its thick and solid shell, is not proof against these small but formidable marauders; and the chocolate-plant is also liable to the attacks of the Bruchi.

A VERY pretty, but, at the same time, a very destructive species of Weevil, is that insect which is known by the name of APPLE BEETLE, or APPLE WEEVIL (*Anthonomus pomorum*).

This little beetle is peculiarly injurious to the apple-trees, surviving in a torpid state through the winter and commencing its attacks upon the apple-trees as soon as the warm sunbeams cause the beautiful fruit blossoms to expand themselves. These flowers are the objects of attack; and little does the pleased gardener think, as he surveys his trees laden with the rich treasures of purest bloom, foretelling future fruit, that the cankerworm is at hand, and that the cherished blossoms will wither and decay and produce no harvest.

As soon as the flowers have burst from their warm wintry garments, the Apple Weevil sets out on its destructive mission. Issuing from beneath the sheltering bark where it has remained throughout the winter, it commences its campaign upon the flowers. It pierces each blossom with its long beak, deposits an egg therein, and moves off to perform the same ill office to another bud. In due course of time the egg is hatched, and out of its shell there issues a tiny white grub, with a black head, that devours the flower voraciously.

Just about this time, the small birds may be seen hopping among the branches and pecking away among the buds with great energy. A casual observer at once concludes that they are engaged in eating the healthy buds and so preventing the tree from bearing fruit; but, in reality, they are looking out for these tiny larvæ: and though sometimes in their eagerness they may pick off the bud, they do no harm by the proceeding, for the bud is already doomed. The bullfinch, indeed, is so very energetic in its proceedings, that in some parts of England it goes by the popular name of Pick-a-bud.

The grub of this beetle is very rapid in its growth, as indeed is needful from the short duration of the flower on which it feeds, and in which it lies hidden from sight. It changes, after the lapse of a few days, from white to yellow—a few days more bringing it to the pupal state—and in another week or so the beetle has attained its perfect development; in fact, from the time that the egg is deposited to the time the beetle is perfected scarcely a month has elapsed.

Let us now follow one of these beetles, a female, through the rest of its life. As soon as it has attained its perfect form, it leaves the spot in which it has passed its little life, and betakes itself to the leaves of the same tree or other trees of the same order. The blossom in which it had lain then shows symptoms which tell but too surely of the events which have taken place within its bosom, and withers away and perishes.

Throughout the rest of the year the beetle remains among the leaves, and conceals itself so carefully that it is seldom seen, but may be obtained by beating the branches and receiving into a sheet the creatures that fall from the foliage, or by the simpler and perhaps more effectual plan of sweeping the leaves with the net so well known to entomologists.

When the cold blasts of approaching winter deprive the leaves of their vivid green, and begin to shake them from their stalks, the beetle changes its residence, and takes up its quarters for the winter in some sheltered spot. It is fond of creeping into the crevices of the rough bark found on old trees, or under stones and stumps. In these chosen spots it would remain safely until the spring, but its life is frequently cut short by the sparrow, the wren, or the titmouse—birds which examine every crevice with jealous eye, and seldom fail to discover the insect lurking within.

Should, however, the beetle escape from its many foes, it awakes to life in the early spring, and, led by instinct, ascends the trees again, and searches for the budding blossoms. In each of these flowerets she bores a hole with her long beak, deposits an egg, and then passes on to another. The object of her life being fulfilled, she dies a natural death, but leaves behind her a numerous progeny to carry on the work of destruction.

The scientific name of this insect is very appropriate—the first, or generic title, being composed of two Greek words, signifying "flower-eater," and the second, or specific name, being a Latin word alluding to the fruit which is especially the object of its attack. Sometimes, however, it will prey on the pear blossom.

It is a little beetle, of a dull brown colour, banded indistinctly with greyish white. The whole of the under parts of the body are black. The reader must not confound the larva of this beetle with the maggot that is found in "worm-eaten" apples. This insect belongs to a different order, has different habits, and will be described and figured in its proper place.

THERE are exceptions to every rule. As a general rule, the whole of the Weevil Beetles are destructive to vegetation, and may be destroyed by man. But the pretty insect called *Anthribus albinus* forms an exception to this rule, and ought to be encouraged in every garden, and especially in every greenhouse. It is a parasite upon that pest of the gardener, the scale-insect, and has been reared from the bodies of those remarkable and destructive creatures. Several observers, anxious to test the real habits of this insect, have placed the female Anthribus in a vessel, together with the scale-insect, and after a while have found a pupa of the beetle within the body of the coccus.

In England this beetle is tolerably plentiful, but, owing to the comparative scarcity of the being on which it feeds, is not so commonly found as in many parts of the Continent. The pine forests are well known to be terribly ravaged by the scale-insect, and would suffer even more severely but for the exertions of several species of Anthribus.

The grub of this insect is rather curious in its form, the segments being deeply cut, as if threads had been tied round them. Little tufts of stiff hairs are dispersed over the body, and the head is very small in proportion to the general dimensions. The perfect insect may be distinguished from the other Weevils by the form of the antennæ, which are tipped with a rather large and abrupt club, consisting of three joints, each of which is five or six times as large as the other joints of the antennæ. The colour of the species which has just been described is a rich chocolate brown, except the end of the body, which is greyish white, and has a rather curious appearance.

All those persons who possess greenhouses will do well to sweep the herbage and leafage with the net, and look for the various species of Weevils which are always to be found in its folds. The greater part may be destroyed as injurious; but any specimens of the Anthribus should be preserved, and carefully conveyed to the greenhouse, where they will give most effectual aid in the destruction of the scale-insects.

WE now come to some Weevils that are very injurious, though for the most part very beautiful, and that carry on their destructive work in a rather remarkable fashion.

The first of these insects is the little creature which is known to entomologists as the HAZEL WEEVIL (*Attelabus coryli*). It is a pretty insect, with red wing-cases and a black head, and may be easily recognised by reference to the illustration.

The reader may probably have noticed in his walks through the woods or in the garden, that the leaves of the oak and hazel are often contorted in a very curious manner, their extremities being rolled up in a hard ball, quite distinct from those which are attacked by the leaf-roller caterpillars, and which are formed into hollow cylinders. These leaves are the residence of the insect which has just been mentioned, and in some seasons no small harm is done to the foliage.

Sometimes the leaves are so completely under the dominion of their tiny proprietors, that they are rolled into a mass much resembling, in shape and dimensions, a lady's thimble. The egg is laid in this leafy mass, and, hidden therein, the little grub passes through its various stages of life, and then emerges to pursue the same work. The grub of this insect is not at all unlike that of the Anthribus, but a short examination will soon detect the distinctive markings.

THE next insect which we have to examine is that most lovely, but most terrible creature, the LISETTE (*Rhynchites Bacchus*).

This is rather a large species, and one that cannot be mistaken for any other insect, its peculiar shape and the splendour of its colouring at once denoting its identity. In England, this insect is chiefly destructive to the apple, piercing the young bud, or newly "set" fruit, and depositing its eggs therein. Several of the stone fruit are subject to its depredations, such as the cherry and the plum, the insect boring into the yet soft and tender "stone," and placing its eggs in the very heart and germ of the fruit. Other species, however, are more especially destructive to those fruit trees, and will be presently mentioned.

In France, this beetle is one of the most formidable enemies that the agriculturist dreads, choosing the vine as its place of residence, and adding another to the long list of foes of that much-enduring plant. Every one who has walked through the vast vineyards of France, and surveyed their æsthetically ugly but practically valuable contents, must have perceived how intimately the prosperity of the vineyard is blended with that of the country. When the vines are healthy and blooming, how cheerful is the prospect of those interminable rows of short, stubbly bushes; but when they are "burned," or suffering under any of the myriad ills to which they are liable, how gloomy is the prospect, and how sad seem the faces of the labourers!

The Lisette, or La Bèche, as the insect is sometimes called, is one of the deadliest foes of this plant, attacking its leaves, and rolling them into that thimble-shaped form which has already been described while treating of another species. An inquiring reader will naturally ask how so small a beetle can roll up a leaf so thick and strong as that of the vine. The feat is accomplished as follows:—The beetle gnaws holes in the nervures of the leaf, and extracts the juices. This injury causes the leaf to bend, so that it almost rolls up of its own accord, and it is then seized by the insect, which deposits an egg in the convoluted leaf, and then completes the operation.

The chamber where the grub lies is neatly lined with silk, thought by some persons to be placed there by the parent, so as to form a soft and secure resting-place for her offspring. I should, however, be inclined to suppose that the silk is produced, not by the perfect insect, but by the larva, as is usually the case amo silk-producing insects.

The process by which another species, *Rhynchites betulæ*, ro the leaf is thus described by Köllar:—"When the female l selected a suitable leaf, she cuts the petiole almost half throu with her beak, so that it hangs down, and is more convenien placed for future operations. She then begins to roll the l together, mostly alone, but sometimes assisted by the ma While this operation is going forward, she also lays her eggs; th is, she pierces the roll, lays an egg in the opening, and pushes in with her beak, in such a manner that it remains on the inn side of the leaf. When she has introduced five or six eggs this manner between the different folds, she rolls the remaini part of the leaf together, so that it is impossible to discov from the outward appearance, in what manner the eggs we deposited."

The numbers of the Lisette are extremely variable, in so seasons being seldom seen, and in others so plentiful, that t authorities are obliged to issue stringent orders for its destructio There is need for such regulations, for, in some cases, the vin of a whole district have been stripped of their leaves by th much-dreaded foe.

The colour of this beautiful beetle is shining fiery crimso with a peculiar glow, like the violet radiance of the ruby.

An allied species of the same genus, the Stem-borer (*Rhy chites alliariæ*), derives its name from the manner in which carries on its depredations. This weevil, instead of laying eggs in the rolled leaf or the tender blossoms, drills a hole the young twigs, and therein deposits the egg. Grafts are pecially subject to its attacks, and the beetle is therefore mu detested by gardeners. The colour of this species is deep ste green.

I would here advise my readers to examine for themselves t mouth, beak, and feet of the weevil, for though they can l understand how so terrible a weapon is concealed under so har less an exterior, they will also be struck with admiration at t wonderful adaptation of means to end. Placed at the extremity of the long snout or beak are the two small but sharp and powerful jaws, calculated to cut their way with equal force and rapidity, and so arranged as to enable the insect to bore a hole equal in depth to the length of the beak.

The length of the beak varies according to the duty which it has to perform. In some species, it is short, broad, and stout, while in others it is of wonderful length, and in either case is always curved downwards. The common Nut Weevil, which we shall shortly examine, has a very long beak; but a South African species, Rhinomacer, has a beak nearly three times as long as the body, and fine and thin as a lady's needle.

Whenever the beetle is a borer, the eyes are set at the base of the beak, so that they may not be injured by friction against the substances with which the beetle bores. And lovely eyes they are when properly magnified and illuminated, set like gemmed network, and glittering even after death. The feet, again, are so constructed as to take a very firm hold of an object, as can be proved by any one on whom a large weevil has crawled. Armed at their extremities with a pair of sharply-curved and divergent hooks, that seize upon an object as a grapnel seizes the ground, and furnished with a corresponding pair of large pads, that look very like oval hair brushes, they can cling firmly to smooth or rough surfaces with hardly any exertion on the part of the insect. Indeed, the whole of the structure is well worthy of examination; and even in the apparently dull and soberly apparelled species, the surface of the wing-covers is sculptured into patterns so rich and luxuriant in design that designers and carvers would find them admirable models for their art.

The perfect insect of the Stem-boring Weevil appears in the middle of summer.

Almost every kind of fruit tree is attacked by this destructive insect, which is mostly found upon the young shoots that are not more than four or five inches in length. The process by which the feat is accomplished is so remarkable that it can only be described in the words of one who has watched the insect in the act of depositing its eggs:—"As soon as she has reached the most suitable part of the tree, she marks the place first by a prick or a small cut, where she intends to cut off the bud or shoot. She then recedes about a line upwards, and, lying with her head turned downwards, on the side which is farthest from the tree, proceeds to bore with her proboscis until she reaches the middle of the shoot. With it she also widens the chambers, and prepares it for her offspring. She then places herself over the entrance and lays an egg, which is pushed in by the proboscis and conveyed to the proper place. This operation lasts an hour.

Immediately afterwards, the female returns to the former place to cut off the shoot, moving her proboscis from side to side until she has cut it to a certain depth, and she then gives some decided thrusts, which she continues until the shoot only hangs by the under part. When she observes this, she climbs up on the point of the twig, to make it fall over by her own weight. It not unfrequently happens that it falls immediately, the shoot having been previously cut so as to remain attached to the stem of the bark alone. If, however, the beetle finds that the pierced shoot does not fall, she turns back to labour again at the same place, and cuts still deeper through the branch; and if she is not able to divide it, she climbs up once more to the further extremity, by which means she generally succeeds in bringing the separated branch to the ground."

This is a labour of time, and occupies several weeks of the insect's life. In order to check as far as possible the depredations of this insect, the best method is to collect all the detached twigs and burn them, so as to destroy the enclosed eggs and grubs before they can change into the perfect insect. It will also be found useful to convey a sheet very quietly beneath the tree, and then to shake and beat its branches. It is astonishing what a number of destructive insects will be caught in the sheet, of which the weevils will constitute a very large portion, their instinct teaching them to loosen their hold when alarmed, and to fall to the ground. Some caution must be observed in bringing the sheet under the tree, as this beetle is peculiarly wary; and if any noise or disturbance be made, it will fall to the ground before the sheet can be placed in the proper position.

Another species, the COPPER WEEVIL (*Rhynchites cupreus*), is at times destructive among the plum and apricot trees, injuring not only the fruit, but also the leaves and young shoots.

This very destructive insect cuts down the object on which it lays its egg in a similar manner to that which is employed by the species that has just been described. It prefers the fruit as a nidus or cradle for its young, and lays its eggs in them when they are still very small and immature. She cuts the stem half through before she lays the egg, and then finishes the operation, the object being that the grub shall find itself upon the ground when it is about to assume the pupal state, and to leave the fruit for the purpose of burying itself in the earth.

We often see the young plums, apricots, and similar fruit, lying on the ground when only in their early and green states, and we call them "blighted," one of the terms which the gardener uses when he does not know the cause of death. Now, in most cases, these fallen plums are the home of the larval weevil, and have been severed from the tree by the parent insect. All these fallen plums should be gathered and burned, so as to destroy the grub. In some seasons this destructive weevil is so plentiful, that it strips whole trees of their fruit, going systematically from plum to plum, laying its eggs in them, and severing them from the branches on which they grew.

The mode by which the mother-insect deposits the egg is very ingenious. She first cuts through the comparatively thick skin of the young fruit, and raises a little flap. Under this she bores a hole with her beak, pushes the egg to the end of the hole, and then shuts down the flap, so that water is effectually excluded from the hole, and the pulp is enabled to close up and heal the aperture.

It may be here mentioned that the wingless species of beetles may be excluded from trees by fastening a broad strip of tin, zinc, or even brown paper, round the trunk, and covering it with tar, which should be covered as often as it becomes hard and dry. The generality of these insects, however, possess wings, and can use them effectually; so that the only hope of diminishing their number lies in a knowledge of the habits, and particularly of the localities in which they deposit their eggs. In moderation, these weevils may be useful to the plants by preventing an over-luxuriant crop of fruit, and performing the work which a careful gardener is always ready to execute.

Our last example of this destructive genus is the VINE WEEVIL (*Rhynchites betuleti*), a species which attacks the leafs of the vine in a manner similar to that employed by the Lisette, rolling up the leaf into a hard mass, and laying one egg in the midst of the injured leaf. The colour of the Vine Weevil is deep steel blue. Both these species appear in June and July.

CHAPTER XII.

PEAR BEETLES—Their General Shape and Numbers—The CLOVER WEEVIL—Its Habits—Mode of preparing Minute Insects—Ravages of these Beetles in the Garden—The CUDDY, or DONKEY WEEVIL—Its Destructiveness to the Peas—Cocoons of the Weevil—CLEONI and their Habits—The OBLONG WEEVIL—The PEAR WEEVIL—The GROOVED WEEVIL, and its Ravages among succulent Plants—Indications of its Attacks—The Larva—Its Colour and Habitat—Mode of destroying it—The APRICOT WEEVIL—Mode of checking its Ravages.—NUT WEEVIL—Its Habits—The Grub and its Characteristics—Introduction of the Egg—Method of destroying it—WILLOW WEEVIL—Its Habits—The NETTLE WEEVIL and its Uses—ACORN and DOWNY WEEVILS, and their Habits.

THE two curious little beetles which we have now to examine belong to a very large genus of Weevil, which is familiar to the entomologist under the name of APION, and to the general public under the title of PEAR BEETLES.

This is a very appropriate name, Apion being a Greek word signifying a pear, and is given to the beetle because their bodies are shaped much after the fashion of a jargonelle pear. None of them attain any great dimensions, and many are decidedly minute, requiring some care on the part of the entomologist to display their many beauties in the best manner. Their bodies are hardly so large as the head of a minikin pin, and their limbs seem to be almost surpassed in diameter by a human hair.

There are some seventy or eighty species of Apion, from which have been selected the two examples which will be briefly noticed. Those who wish to obtain further information on this subject may obtain it by reference to many portions of the *Transactions* of the Linnean Society.

The Clover Weevil (*Apion trifolii*) derives its name from the plant on which it feeds. Many species of Apion are destructive to the clover, and it is found that the different species of that plant will attract different species of Apion. The purple and white clover, for example, are devoured by two different species of this genus—*Apion flavifemoratum* preferring the former, and *Apion flavipes* the latter, variety. The entomologist who is engaged in stocking his cabinet will always find a valuable harvest of weevils if he sweeps the clover-fields at different epochs of the growth, and will also discover that the representatives of the genus Apion will accumulate so quickly on his hands that he will have but little time for identifying.

I was accustomed, when engaged in this pursuit, to put all the beetles into a wide-mouthed bottle, containing spirits of wine, in which a little corrosive sublimate had been dissolved, and to set them roughly on triangular slips of card, whenever I found an opportunity of so doing. Sometimes they happened to settle themselves so favourably upon the gum-covered card that no further trouble was necessary, but even in those cases where it was needful to reset them they were readily loosened from the gum, and at the same time rendered pliable, by holding them for a short time in steam.

I invented a plan for steaming dried insects, which was very simple and perfectly effectual. Taking a common wine cork, I cut off a flat disc, about one third of an inch in thickness, and then removed the substance in the centre, so as to make it into a rude ring. This ring was made just large enough to be slipped over the spout of a common tea-kettle.

Nothing more was necessary, when the body and limbs of a dried insect were to be made pliable, than to put the kettle on the fire, slip the cork ring over the spout, and, when the steam began to issue from the spout, to stick the insects on the cork ring in such a manner as to allow the steam to play over them. In this manner an insect can be softened in a very few minutes, without the least injury; whereas, in the ordinary method, twelve hours at least are consumed before the limbs can be moved without danger; and a large specimen will often require twenty-four hours of immersion in a damp atmosphere.

One species of this genus, *Apion radiolum*, is sometimes very annoying to gardeners, penetrating into the stem of the hollyhock, and laying its eggs in the soft substance of its interior. Within the stem it undergoes all its transformations, and emerges in October in its perfect state. The colour of this insect is a dark blackish green. The same beetle is also found plentifully in the well-known mallow (*Malva sylvestris*), so plentiful about hedges and roadsides, and so ornamental from its pretty purple-red petals and soft downy leaves.

Two closely allied species now come before us, the habits of which are very similar. These are the SMALL PEA WEEVIL (*Sitona* [or *Sitones*] *sulsifrons*), and the CUDDY, DONKEY, or STRIPED PEA WEEVIL (*Sitona lineatus*). The former of these insects is remarkable for being the smallest species of the genus, as may be seen by reference to the illustration. It is dull brown in colour, and is altogether a very inconspicuous insect.

The Cuddy, or Donkey, is so called in Scotland on account of its sober grey colour, which somewhat resembles that of the animal whose name it bears, the peculiar antennæ taking the place of the ears. Both these beetles are determined enemies to the peas, feeding, not on the fruit, but on the young leaves, cutting out large curved pieces that look as if they had been removed by a single bite.

In order to be ready for the peas as they emerge from the soil in the early spring, these weevils are among the number of those insects which survive the winter, hidden away in all sorts of nooks and crannies, under rough bark, beneath the shelter of thick moss, and in similar localities.

The colour of the Cuddie is grey, diversified with some black lines. The antennæ are slightly tinged with red. There are rather more than twenty species of this genus.

Several members of this large family are remarkable for the beautiful cocoons which they construct. These singular dwellings are more or less oval in shape, and are so constructed of stiff silken threads that they look as if they had been made of gauze stiffened with gum. The meshes are open, so as to allow the enclosed insect to be seen through them; and when examined through a magnifying-glass, the meshes appear to be nearly circular, like the holes in perforated cardboard. The cocoons are attached to the under side of leaves and twigs, and are very pretty objects.

The weevils which are most noted for the construction of the cocoons are the species which belong to the genus Cionus—little, round-bodied beetles, marked with dark spots and lines. The insects may generally be found upon the verbascum, on the leaves of which the larvæ feed, and upon which the cocoons are fastened. One species of weevil, *Phytonemus tigrinus*, makes the cocoon upon the leafage of the wild carrot, drawing the slender leaves together, and attaching the cocoon to them. The cocoon is very variable in dimensions, but the average size equals that of a large cherry-stone. This is a prettily-marked beetle, spotted and streaked so as to have gained the specific title of "Tigrinus," or tiger-like. It is found plentifully near Dover.

We now come to an insect belonging to a genus which can scarcely be reckoned among friends or foes, inasmuch as its members do much good and much harm, according to the plant in which they take up their residence. This is the *Cleonus sulcirostris*, a beetle which, I believe, has no popular name. It is one of the weevils that reside in gall-like swellings in the roots or stems of plants, and is therefore well calculated to inflict serious injury on the plants in which it takes up its residence.

This species is known to inhabit the root of the common thistle, causing it to swell as if afflicted with the gout, a single larva being found in each protuberance. Mr. E. Smith tells me that in a limited space he has seen at least one hundred thistles affected by this insect, which has the property of killing the plant just before it goes to seed, thus effectually checking its growth.

As thistles are to be ranked among the plants which we desire to extirpate from our gardens, we must rank among our friends the insect which destroys them. Its form may be recognised by the illustration, and its colour is a dark grey-brown, looking as if it were a black beetle powdered with flour.

Another species of the same genus (*Cleonus linariæ*) is, however, obnoxious to gardeners, preferring certain species of Antirrhinum (known popularly by the name of snapdragon or figwort), boring into their roots and causing them to wither away.

Another curious insect is the OBLONG WEEVIL (*Phyllobius oblongus*), a long-bodied, slender-looking insect, with delicate long antennæ, and of a pale reddish brown colour. This species never exhibits the beautiful golden lustre which is seen upon so many of our smaller Curculionidæ. The perfect insect may be found in May, and it is peculiarly destructive to the apricot, peach, plum, and other stone-fruit, as well as to the apple and the pear. It feeds on their young leaves, and seriously checks the due growth of the tree.

There is an allied species, the PEAR WEEVIL (*Phyllobius pyri*), that is mostly found upon the tree from which it derives its name. In colour it is dark brown, and bears some resemblance to the apple weevil already described. It appears earlier than the preceding species, being found in April in its perfect state.

The generic title, Phyllobius, is composed of two Greek words, signifying a liver on leaves, and is given appropriately to those insects which feed upon leaves in preference to blossom, fruit, or stem.

OUR next group of Weevils comprehends some very common and well-known species, all of which may fairly be reckoned among the foes of our gardens.

One of the worst of our garden foes is the GROOVED WEEVIL (*Otiorhynchus sulcatus*), so terribly injurious to nearly all our succulent plants. Owing to its peculiar habits it needs not to bore deep holes into the plants in which its eggs are laid, and therefore it has a broad, short, and rather stout beak, the antennæ being set nearly at its extremity. The perfect insect is rather large in comparison with the rest of the British weevils, and is rather richly, though soberly coloured, the wing-cases being black, with a decided gloss, and taking a certain velvety richness from the numerous short grooves which are ploughed along the upper surface. As is mostly the case among the Curculionidæ, a number of short hairs are scattered over the surface, and in this species are pale grey.

It is generally during the winter that the destructive capabilities of this beetle are especially indicated. Several of our succulent plants, such as the sedum, may be observed to droop and pine, and finally to perish, without any assignable cause. If, however, the earth be gently lifted from the lower part of the stem and the roots, the cause of the gradual decay will be sufficiently evident in the person of a moderately-sized, fat, white grub, which has made for itself a very pleasant habitation among the roots, and is silently sapping the very life of the plant from which it derives its sustenance.

This grub is the larva of the Grooved Weevil, and may be found just below the junction of the stem and the root, gnawing carefully round the plant, and cutting a deep channel wherever its sharp teeth have set themselves. As is the case with nearly all subterranean grubs, its colour is white; and as it does not travel from the place where it was hatched, it requires no feet, and has none. In order, however, to enable it to traverse the circumference of the plant on which it feeds, it is covered with numerous short and stiff hairs, which answer the purpose of feet when the creature desires to move, and are used much as the earthworm employs the curious hairs with which its many-ringed body is studded. It is a fat, fleshy kind of grub, and always is slightly curved. In length it measures about half an inch when full grown.

At the end of spring and the beginning of summer, the larvæ cease feeding, put on their pupal form, and remain in this helpless state for a few weeks, when they burst forth from their concealment in the perfect form. The surest mode of ridding the garden of these pests is to raise the earth about the roots of the various succulent plants, and to search carefully for the insect. Some care is required in instituting the search, as the colours of the beetle are so sombre, that an unpractised eye would often fail to discover it.

Moreover, the instinct of all these beetles teaches them to contract their limbs and to feign death whenever they are alarmed, so that not a movement will betray the insect when it is once alarmed. Many of them leave their hold of the leaves or twigs, and fall to the ground, when they are frightened, thus giving great assistance to the entomologist who desires to collect them. He has only to spread a sheet under the trees or herbage, and to beat the leaves with a stick, when the weevils will come rattling down like a hail-shower or handfuls of small shot flung into the air.

We now pass to another species of the same genus, which we may call the Apricot Weevil (*Otiorhynchus tenebricosus*).

This beetle is a terrible enemy to fruit trees that are trained against the wall, the apricot being the greatest sufferer from its attacks. Vines, also, are much damaged by this beetle, the larva of which lurks at the roots, and does infinite damage, though unseen. The perfect insect is fond of hiding in the crevices found so commonly in old walls, and finds a congenial resting-place beneath the rough bark of the grape-vine.

Mr. Curtis, whose experience on such subjects is well known, advises that wherever the wall-fruit fails from no apparent cause, every chink in the wall should be stopped with cement, plaster of Paris, or mortar—the first-mentioned substance being most effectual—and that the rough bark of the vine should be stripped off in the early spring. Whitewash, also, should be liberally used in the interior of hothouses and greenhouses; and in October, the earth round the roots should be removed, and a diligent search made after the beetle, so as to prevent it from laying its eggs. These minutiæ are somewhat tedious, but the gardener will be well rewarded by the improved condition of his fruit trees.

If the beetle should be found lurking along the base of the wall, it will be advisable to lay salt thickly along the wall, as the insects are killed almost instantaneously when they come into contact with that substance. Strong tobacco-water poured along the base of the wall will have the same effect, and infusions of aloes and quassia are thought to be useful.

This beetle is found most plentifully in chalky districts. Its colour is black and shining.

Most of my readers have had the misfortune to put into their mouths a "worm-eaten" nut, and to have been painfully conscious of the bitter, nauseous, astringent dust with which the interior of the nut is filled. Snugly ensconced in the middle of the kernel is seen the round, fat, white grub that has done all the mischief, and changed the sweet and wholesome substance of this nut into a black powder as unsavoury as the apples of the Dead Sea.

This grub is the larva of a very common weevil, called scientifically *Balanius nucum*, with a roundish body and long curved beak, of so peculiar a shape, that a reference to the illustration will enable the reader at once to identify it. The colour is a peculiarly rich velvety brown, owing to a coating of short, soft hair, and some bands of a dark brown traverse the body.

As soon as the young nut shows itself after the withering away of the blossom which gives it birth, the female Nut Weevil bores a rather deep hole into its soft substance with her long beak, and places an egg in the pulpy interior. The egg lies in its cradle for about a fortnight, and is then hatched, finding itself at once in the midst of a plentiful feast.

It remains in the nut until the fruit is quite ripe, being taught by instinct not to eat the vital portions of the nut. When the time arrives for its change into the perfect state, the grub turns its jaws against the shell of the nut, drills out a round hole, pushes its way out of the aperture, and falls to the ground. It then wriggles its way into the earth, where it lies in the pupal state until the end of the following spring, when it makes its final change, and emerges in its perfect form.

A knowledge of the habits of this creature is absolutely necessary to enable the gardener to free his plants from its ravages. When once a nut is attacked, there is no hope for it. The hole which the parent weevil bores into its base is so small, and is so rapidly filled up, that no external indication remains to point out the injured fruit. The only method of thinning the numbers of this pest is to destroy the grubs before they can change into the perfect form, and reproduce their kind.

This object may be accomplished in several ways. The all-potent solution of ammonia may be poured on the ground under the trees, so as to kill the grubs which have succeeded in burrowing into the earth, and will be effectual in killing those which have escaped the vigilant eye of the gardener. But the greater number of them ought not to be permitted to reach the ground; and, by a little care, most of them may be destroyed before they have reached their full larval growth.

When the grub is rather more than three-parts grown, its effect upon the nut is to cause the mere shell that remains to ripen before its time, and consequently to loosen its hold on the branch. If the boughs be smartly beaten or shaken before the nuts are ripe, the worm-eaten fruit will betray itself by falling to the ground. Every nut which has thus dropped should be burned without delay, and thus the obnoxious tenant will be destroyed before it has had time to injure more than the solitary nut in which it was found. This operation should be repeated once or twice, and its effect is sure to be useful.

Some gardeners think that a hard pavement under the trees will have a good effect in preventing the grubs from burrowing into the ground, while others prefer a thick layer of tan for that purpose. The former plan, however, is of very little use, as the grub can wriggle itself along at a tolerable pace, even though it be destitute of legs, and would only traverse the smooth hard surface until it reached a spot where it could bury itself without difficulty.

Still, the union of the two first-mentioned methods of operation—namely, the shaking the worm-eaten nuts off the tree in summer, and drenching the ground with ammoniated water in the autumn—is so potent a means of attack, that very few insects will succeed in reaching the perfect state.

There are several species of this genus found in England, one of which, the ACORN WEEVIL (*Balaninus glandium*), is very destructive among the oaks, treating the acorns just as the above-mentioned species treats the nuts. Another species is the

Downy Weevil (*Balaninus villosus*), the larva of which especially affects the cherry, and in some countries is said to be very injurious to that fruit. They can all be identified by their peculiar forms.

Several other Weevils of this large family are worthy of a passing notice. One of them, the Willow Weevil (*Cœliodes* [or *Cryptorhynchus*] *Lapathi*), feeds upon the tree from which its name is derived, and may be found upon it in every stage of its existence. If we walk by the river-side, and examine the trunks of the willows, we shall frequently discover a vast number of little holes, about as large as an ordinary quill, and partially filled with a sawdust-like substance, some of which is usually seen at the aperture. These holes are made by the larva of the Willow Weevil, and in spite of their very formidable aspect the tree seems to suffer but little from them.

There is another member of the same genus, the Nettle Weevil (*Cœliodes didymus*), which may be reckoned as holding a high place among our garden friends, destroying as it does the common stinging-nettle, so obnoxious to human cuticle. This insect may be readily recognised by reference to the illustration. It is a little, hard, round-bodied, rough-surfaced insect, with a long slender beak, and may be found upon the plant from which it derives its name. It is most energetic in the destruction of the stinging-nettle, stripping it entirely of its leaves and killing it completely.

Before leaving the large family of the Curculionidæ, I ought to mention the Spring Weevils, so called because they are enabled to leap, flea-like, by means of their thick and powerful hind legs. They may be recognised by this peculiarity. Several species of this genus are found in England, and do great harm to our trees; the willow, the elm, and the alder being very subject to their attacks.

In some species the larva resides between the membranes of the leaves, making those curious winding marks which traverse the leaves, and puzzle the inexperienced observer. It is not very easy to identify these creatures, but the best method of attempting it is to allow the leaves to remain on their stem and to enclose them in gauze, tied firmly above and below. If, however, the trees should be in the fields, and the gauze cases liable to be pulled off by mischievous boys, the best method is to gather the branch, place it in water, and tie up the leaves in a gauze covering as already recommended.

CHAPTER XIII.

The Scolytidæ—Their Place among Beetles—Their Ravages among the Elms—Strange Mistakes—A False Accusation, and Innocent Sufferers—Discovery of the true Cause—Habits of the Parent Beetle—The Eggs and their Development—Effect upon the Tree—The Tree and its Bark—The Doomed Guest—Value of a Tree, and impossibility of its Replacement—The College and the Corporation—How to check the Increase of these Insects—The Injecting Syringe—Simple Method of making it—The Scolytus — Its Description, History, and Ravages — The Ash-Borer—Where Found—The Typographer Beetle and its Habits—The Apple-Bark Beetle—Its Destructive Powers—Colour and Shape of the Beetle—The Scotch Pine Black Beetle—Its peculiar Ravages—The Cylinder Beetle—Its Shape and History.

Leaving the great family of the Curculionidæ, we now come to a very much smaller group of beetles called the Scolytidæ. Entomologists are not quite agreed as to the exact relationships of this group, some forming them into an isolated family, and some placing them at the end of the Weevils. As, however, this book is not intended as a treatise on systematic zoology, there is no need to mention more than the fact.

For some years, the elm-trees of the metropolis and its environs have been liable to droop and perish. Every year some noble tree withers away, the bark falls off in patches, and the tree, after vainly endeavouring to recover itself, loses the fresh brilliancy of its foliage, refuses again to put forth its leaves, and in the ensuing summer stands forth a dead and leafless skeleton.

Before the true cause of this ailment was known, various suggestions were offered. The ever-mischievous boys were at one time suspected of doing the damage, and the elm-trees were carefully fenced off only to perish as fast as ever. Then the drainage system was attacked as the cause of the destruction. It was said that the drains carried away the moisture which used to supply the tree with the needful nourishment, and therefore that they caused its death. There was a plausibility about this suggestion that made it very popular for a time.

The next suggestion was that the boys were really the cause of the tree's death, by knocking the bark off with stones. There certainly is not the least doubt that if boys could by any possibility achieve that feat, it might fairly be laid upon their shoulders. But any one acquainted with the boy-nature would be equally certain that, if such projectiles as stones could by any possibility destroy a tree, all the trees in England would have been killed many centuries ago, and so the accusation fell to the ground.

A suggestion, which now appears to be almost ludicrous from its utter extravagance, gained at one time a considerable reputation. We were then in the very height of our war fever. The name of Buonaparte was the bugbear of Europe, and especially of England. Hating the French was popularly thought to be one of the first duties of a true Briton, and hardly any story, however absurd, would fail of commanding a favourable reception, provided only that it were to the discredit of the French.

So, some astute individual, taking advantage of the attitude of the popular mind, had the audacity to put forward a suggestion that the destruction of the trees was owing to a French conspiracy, and that our sentinels had been bribed to bark the trees with their bayonets. There was some ingenuity in the idea, for it was found that the bark was cleared from the trunk just about the height which a soldier could reach with a fixed bayonet. The ridiculous accusation was eagerly adopted on all sides, and I believe that several very innocent sentinels suffered severely for the injuries done to the trees.

At last the true cause was discovered, in the person of that tiny and apparently insignificant beetle, the *Scolytus destructor*. No one who was unacquainted with the history of this insect could conceive that so small a creature could be so mischievous, and that a single beetle, barely the sixth of an inch in length, could lay low the stateliest elm with as much certainty as the axe of the woodman or the firebrand of the incendiary. Various trees are attacked by this beetle, and even the pear has fallen a victim to its ravages. The mode of destruction is as follows :—

The mother-beetle begins by nibbling a round hole in the bark of the tree, and pushes her way onwards as far as she can penetrate, taking a direction between the bark and the outer layer of wood, and cutting a tolerably deep groove in each as she proceeds. She then lays a number of eggs along the channel, just as a gardener sows peas in a furrow, and then, the labours of her life being over, she dies. It has been noticed, I believe, by Captain Cox, that when the mother-insect has thus completed her work, she retreats to the entrance of the tunnel, and there perishes, her dead body forming a kind of stopper to the hole, and preventing enemies from gaining admission.

As soon as the young larvæ are hatched, they commence the work of destruction. Taught by the wondrous instinct implanted in them by their Divine Creator, they all start at right angles to the channel in which they were born, and form similar burrows to that in which they were hatched. There is, however, one essential difference. The channel cut by the parent is as nearly as possible of the same dimensions throughout, whereas those made by her offspring are very small at their origin and very large at their extremity. This increase of size is caused by the growth of the creatures that cut them.

The reader will not fail to notice how beautifully the habits of the insect are adapted to its necessities. Were the young grubs to proceed in an uncertain direction, they would probably interfere with each other, cut their way into their neighbours' tunnels, and interfere with each other's growth; whereas, each diverges from the other, so that as the insect and its habitation increases in dimensions, more space is available, and when the brood have completed their course, their radiating channels greatly resemble an oriental fan, the mother channel representing the stem, and the grooves of the offspring doing duty for the ribs.

The necessary consequence of this proceeding is, that a piece of bark, equal in size to the mass of the tunnels, is completely separated from the wood of the tree, and rendered useless; and when a tree is attacked simultaneously, as is often the case, by several hundred beetles, the effect is most disastrous. All physiologists know how dependent on the skin is the health of a human being, and how fatal is the effect of an extensive burn, not so much from the absolute pain, or shock or injury to the vital organs, but simply because so large a portion of the skin is unable to perform its functions. They know how a young lad was unwittingly killed by representing a golden angel in some masque, the gold leaf with which he was covered choking up the pores, and killing the boy as quickly as if he had suffered from severe burns.

Similarly, the tree is dependent on the bark for its very life; and though the two cases can only be considered as analogous and not identical in the mode of action, the result is the same in both.

All botanists know that the life of the tree depends on the bark. We all know many a grand old tree, the interior of which has long decayed away, and which yet holds up its proud branches, and waves its foliage as gaily in the breeze as if it possessed the whole of its substance. I well remember a yew-tree in a country churchyard which was as hollow in its interior as a chimney, and which was large enough to accommodate six or seven men at once. It used to be considered rather a feat to enter the trunk at the base, creeping through the low aperture which gave admission to the interior, and then to climb up the hollow trunk after the fashion of chimney-sweeps (not exactly to the benefit of our jackets and trousers), to emerge through another aperture at the top of the trunk, and then to descend by the branches.

But, should even a comparatively narrow band of bark be removed from the trunk, the whole tree is deprived of its nourishment and dies. It is scarcely needful to remind the reader that our forest trees increase by means of the bark, depositing a fresh layer of wood every year, and, in many species, marking the concentric layers so sharply that the age of the tree may be read as easily as if its years had been entered in a book. They are not all of the same thickness. Some years seem always to be more genial than others, and when the trunk is sawn across the concentric rings which mark those seasons are much thicker than the others. Still, the nourishment of the tree comes through the bark, and the tree is as dependent on the bark for its juices as are our limbs upon the arteries that convey blood from the heart.

In the vast forests of Northern America, the woodman brings down many a noble tree by the simple process of "girdling," *i. e.* taking off a ring of bark around the trunk, and then leaving it to die and decay and be blown down by the tempest.

Now, the practical result of the radiating galleries cut by the Scolytus is, that the tree is as effectually girdled by the myriad larvæ that separate the bark from the wood as if it had been subjected to the axe of the woodman. It is always a pitiful sight when a fine old tree falls before the axe. It is a loss which can never be replaced. The finest edifice may be burned or fall through age, and we may hope to see it raised again in all its beauty, but an old tree, when felled, is lost for ever as far as we are concerned.

Generation after generation of human beings have been born, and lived, and died, since it first thrust its tender shoot above the soil. The face of the country has been changed. Waste lands have become smiling fields, barren valleys have been metamorphosed into busy towns. Revolutions have swept over the land, dynasty after dynasty has possessed the throne, and the grand old tree has endured through it all. When we cut it down, we seem to sever a link in history; and when we see it lying prostrate on the ground, and a bare empty space where we used to welcome its towering foliage, we feel a void in our hearts and sorrow as if for an old friend. I do, at least, and so do many others.

Some thirty or forty years ago, the Mayor and Corporation of a certain university town presented their compliments to the principal of a certain college, and, calling his attention to a row of magnificent trees that belonged to the college, begged that they might be cut down, as in rainy weather they dripped upon the heads of passengers. The principal of the college returned *his* compliments, and begged to say that he would much sooner cut off the heads of the Mayor and Corporation.

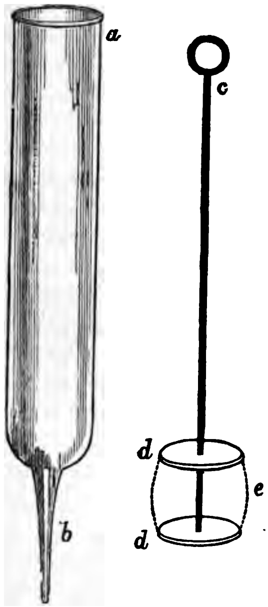
Even when the destruction of the tree becomes a necessity, when there is special need for the timber which it affords, or when it is decaying through age, its fall has much that is sorrowful about it; but when a fine tree perishes in the very vigour of its age, without any necessity, when its life is desired by all who know it, and when it falls a victim to a little brown beetle, no one can see its fall without sincere regret.

The question naturally arises, how we are to free ourselves from the attacks of this insect. The answer is obvious. The disease and its remedy must be proportioned to each other, and a very sharp remedy has to be employed in the present case.

As soon as the drooping leaves of a tree show that its life is failing under the repeated attacks of this little beetle, let it be cut down without mercy. A tree thus overpowered by the beetle is like a house in a thickly-populated neighbourhood which has been overpowered by flames. It is already doomed, and the best mode of saving others from a similar fate is to anticipate the course of events and cut it down. Then, let all the bark, together with the outer layer of wood, be removed and burned, and by this act thousands upon thousands of the Scolytus will be destroyed before they can accomplish their destructive mission and plant new families to carry on the same labours. Every tree that shows these signs should be treated in the same manner, and by steadily adhering to this plan of action, the number of the Scolytus may be greatly diminished.

This procedure is analogous to the removal of a limb in hopes of saving the life of the body, and, like amputation, should not be employed except under urgent necessity. Whenever there is a hope of saving the tree, the gardener should use as much care, and expend as much attention, as does a surgeon upon a wounded or diseased limb which he thinks he can save. There is yet left open one course by which a tree may possibly be saved by a patient and sharp-eyed gardener, provided that the beetles have not succeeded in running their furrows completely round the trunk.

Let the "Gishurst Compound," so favourably known to all cherishers of a garden, be properly diluted, and then applied in the following manner. The requisites are a small bradawl, a long-nosed syringe, and a vessel full of the diluted compound. Any one can make the syringe; and as it will often be useful in the garden and the greenhouse, I will just describe the method of its manufacture.



Get a large glass tube, and see that one end of it is cut off quite level and the edges rounded. This is managed easily enough. All you have to do is to file a small notch in the tube and then bend it away from the notch, when it will snap across with perfect ease. In order to round the sharp edges, nothing more is needful than to hold the broken edge in the flame of a spirit-lamp for a minute or so, when the sharp edges which could cut like razors will become smooth and rounded of their own accord.

The next process is to mark out the length of the proposed syringe upon the glass tube; and when that point is settled, the tube should be held in the flame of the spirit-lamp, care being taken to approach it gradually, so as to avoid cracking it with the sudden heat, and to hold one end in each hand, so as to support it equally. It will speedily become red hot, and as soft as melted sealing-wax; and when that is the case, the hands should be separated with a moderately quick, but not jerky pull, and the tube will then be divided, each portion having a long, slender, tapering extremity.

Here you have the body of your syringe, and the rest is comparatively easy. Break off the projecting and tapering extremity to a suitable length, and then place it again in the flame of the lamp, so as to round its aperture, and then work it about until it is quite straight. The tube will then look as at *a* in the illustration, the tapering point being shown at *b*.

Then take a piece of very stout wire; bend one end of it into a ring, as is seen at fig. *c*; cut a couple of wooden discs, that just slide easily into the tube; fix one into the end of the wire and the other a little above it, as is shown at *d d*. Then, wind some thick, loosely-twisted string into the space between the wooden discs, until it is nearly filled, and then wind soft cotton twist, such as is used for wicks, upon the string, until it forms a circular pad projecting slightly beyond the discs, as is shown by the dotted line at *e*.

Your syringe is now complete; and rough and simple as it looks, it will perform its work right well. Those who happen to possess regular injecting syringes will of course use them, but the primitive instrument thus easily manufactured will answer quite as well. When you wish to fill the syringe, all that is needed is to push the wire into the tube, so as to bring the piston to the bottom; then work it like a regular syringe. Practically, it will be found useful to soak the piston in water for a few minutes before using it for the first time; and this precaution should be taken whenever it becomes dry.

Being armed with the syringe and the bradawl and the Gishurst compound, the gardener commences his campaign against the Scolytus. He searches for every hole made by the insect, pushes the bradawl well into the tunnel so as to clear a passage, and then, filling the syringe with the solution, he injects it smartly into the burrow. A little peg of wood is then driven into the aperture of the tunnel, so as to prevent the fluid from escaping, and every beetle and larva and pupa will be dead in a very short space of time. Any month in the year is suitable for this operation, but August seems perhaps to be the most favourable, as the insects may then be found in all their stages.

The larva of the *Scolytus destructor* is a little, thick, fat, stout grub, white in colour, and always more or less curved—unable, indeed, to assume a straight attitude. The upper part of the back is deeply wrinkled, and the head is of a stout, horny texture, armed with a pair of very powerful jaws, these being needed in order to enable the creature to gnaw away the comparatively hard substances on which it feeds. Hundreds of these larvæ may be found in a very small space, merely by stripping off patches of bark wherever it appears loose and easily separable; and, on contemplating them, it is impossible to avoid a feeling of annoyance that these little, soft, insignificant grubs should be the arbiters of fate to a stately tree, the growth of centuries.

The perfect insect is a little brown beetle, with a cylindrical body abruptly and obliquely cut off at the end. The head is deeply sunk into the thorax, and the antennæ are rather curiously formed, the basal joint being very long, followed by a number of very little joints closely pressed upon each other, and they are terminated by a very large-headed and abrupt club, of an oval shape.

It has already been mentioned that this species is mostly found in the elm, though it does extend its ravages to other trees. Even the kingly oak, with its astringent bark and hard wood, does not escape these tiny foes.

The colour of this most destructive beetle is as follows:—The large thorax and head are black and shining, and very hard and smooth, formed so as to permit the creature to pass through the narrow channel which it cuts. A quantity of very short and fine grey down is seen upon the head. The colour of the wing-cases is dark blackish brown, and they are marked regularly with very minute pits. It must be remembered, however, that the colour of all these wood-boring beetles is apparently variable, some specimens being yellow, while others are of a pitchy blackness. This discrepancy in the tinting is due to the presence or absence of light. So long as the beetle remains under the bark, sheltered from the light, it remains in its semi-bleached condition; but when it emerges into the open air, the colour-giving rays of the sun act upon the surface, and gradually deepen its hues to brown so deep that it may almost be called black. Many insects are liable to similar changes of colour. The chrysalis of many a moth, for example, is quite white when it first emerges from the shed larval integument, and becomes quite deep brown in the course of a day. A very familiar example of this phenomenon may be found in the common cockroach, the natural colour of which is reddish brown, but which is seen of various tints—creamy white, pale chestnut, or even mottled like a piebald horse.

The observer will not fail to observe the manner in which the end of the abdomen is obliquely and suddenly cut off, as if with a slanting blow from a sharp knife. The legs are reddish brown.

There is a species belonging to this genus, the DWARF SCOLYTUS (*Scolytus pygmæus*), which feeds mostly upon the oak, preferring the young trees, and sometimes killing them by hundreds at a time. It is, however, more plentiful on the Continent than in England.

THERE is scarcely a tree which is not subject to the attacks of one or other of the beetles belonging to this group. One of these beetles, a very little insect with a rather long name—*Hylesinus Fraxini*, or ASH-BORER—is, as its specific name imports, destructive to the ash-trees. The generic name of these beetles is very appropriate, being compounded of two Greek words, signifying destroyer of wood.

This destructive insect burrows under the bark, like the scolytus, and may be found at the same time of year. Mr. Westwood mentions that he has found the larva, pupa, and perfect insect of the *Hylesinus fraxini* beneath the bark of an elm-tree. The dimensions of this beetle are less than those of the scolytus. If any reader wishes to identify the insect, he must look especially at the antennæ, which have a club composed of four distinct joints, and larger and more pointed than is the case with the club of the Scolytus. There is another species of this genus, *Hylesinus crenatus*, which also feeds upon the ash. It is similar to the previously-mentioned species in colour, but is much larger and somewhat darker. The modes of destroying this beetle are the same as those described when treating of the scolytus. The larva closely resembles the grub of that beetle, but the head is just a little smaller in proportion, and the wrinkles about the fore part of the body are deeper.

SEVERAL species of a most destructive genus are figured in the illustration. They are all of small size, but are terribly mischievous among the trees, even in this country; but in other lands, where the forests cover vast tracts of soil, and where the wealth of the country depends in a great measure upon their well-being, the presence of these tiny insects amounts to a national calamity.

The great pine forests of Germany are terribly ravaged by the TYPOGRAPHER BEETLE (*Tomicus typographus*), and it is related that in one year a million and a half of pine-trees were killed by this little beetle. The Germans know it popularly by the title of Turk, that name being a kind of byword, expressing something or somebody that is very destructive, just as we call a mischievous boy a young Turk. The disease—if it may be called by that name—under which the trees labour when assailed by this insect, is called Wurmtrökniss.

If the reader should be desirous of gaining more information respecting the various tree-boring beetles, he is referred to that beautiful work, Ratzeburg's "Forst-Insecten," in which he will find figures of these insects in all their stages. The drawings of the perfect beetle, as it appears when magnified, are beyond all praise, from the wonderful fidelity and force of their execution and the extreme labour which they must have cost the artist.

This is rather a larger beetle than the preceding, and may also be distinguished by the shape of the club at the extremity of the antennæ, which is rounded instead of pointed and oval. The name of Typographer is fancifully given to this insect on account of the winding paths which it cuts in the wood, and which are thought by persons of a very powerful imagination to bear some resemblance to alphabetical letters.

The APPLE-BARK BEETLE (*Tomicus dispar*) is destructive to the trees from which it derives its name, and upon which it is almost exclusively found.

This beetle, instead of confining itself to the bark, makes holes which penetrate deeply into the wood; and when the tree is not a large one will nearly reach its centre, the channel being on an average about an inch and a half in length. In themselves these holes could do but little damage; but as they form the birthplace of destructive larvæ, and would also admit water into the living wood, they become extremely injurious to the tree. The holes are mostly bored in a slanting direction, some upwards and some downwards, and it is these latter which are most calculated to inflict injury upon the tree.

The beetle makes several of these tunnels in various directions, and then lays her eggs therein. Within the tunnel is always a quantity of whitish powder, which looks as if some efflorescent salt had exuded from the wood. Kollar thinks that this substance is formed by the mother-beetle, and intended to form the nutriment of the young at an early age, before they are strong enough to devour the wood.

The colour of this beetle is not unlike that of the Scolytus, but the wing-cases (in the female) are rather larger in proportion, blacker, and are covered with down. Moreover, the furrows are not so deep, and the pits not so bold as in that beetle. The male is barely half the size of the female and different to her in colour, having thus obtained the specific name of "dispar," or unlike. The colour of his wing-cases is chestnut, and the thighs are reddish, whereas in the female they are black. In both sexes the feet are yellow.

ANOTHER species belonging to this family needs a brief notice. This is the insect known popularly by the name of SCOTCH-PINE BLACK BEETLE (*Hylergus piniperda*). This beetle is scarcely so injurious as many others, because it mostly restricts itself to the side branches of the tree, leaving the trunk untouched. Still, it quite spoils the appearance of the tree, destroying the side branches by boring into them when very young and living in the pith. The colour of this beetle is black; the wing-cases are irregularly streaked and entire at their tips, and the thorax is much narrowed in front. There are about ten or eleven British species of this genus.

Before we quit these wood-boring beetles, we ought to notice the CYLINDER BEETLE (*Platypus cylindrus*), the only British example of its genus. This curious beetle is, as its name imports, very cylindrical in shape, and may be known, not only by that peculiarity, but by the notches in the sides of the thorax, into which the thighs are received.

The Cylinder Beetle inhabits the oak, and its larva is similar in size and general appearance to that of the Scolytus, but it is different in shape. It does not taper from the shoulders to the tail, but swells suddenly from the head to the shoulders, retains the same thickness nearly to the end of the body, and then the last three segments suddenly diminish to a point. The head is very small in proportion to the body, but the jaws with which it is armed are curved, sharp, and powerful. Several rows of tubercles are disposed along the sides of the body.

CHAPTER XIV.

LONG-HORNED BEETLES, or PRIONIDÆ—Their Form and Qualities—The GREAT PRIONUS—Its Larva—Curious Instinct—Exotic Species and their Ravages—The WASP BEETLE—Why so called—Annoying to the Gardener—The Larva: its Shape, Colour, and Habits—The MUSK BEETLE—Beauty of its Appearance—Its Injuries to Trees—The SALLOW BEETLE and its Habits—The ASPEN BEETLE—Its Form and General Appearance—Its Ravages upon the Ash-trees—An useful Parasite—Cocoon of the Larva—Other Species of the Genus—The ASPARAGUS BEETLE—Its curious Larva—Other Species of the Genus and their Habits—BLACK FLEA—Its Appearance, Minute Dimensions, Ravages, and best Mode of destroying—The CHRYSOMELIDÆ—Their Habits, and the Damage which they do to the Trees—The COCCINELLIDÆ and their Uses—The common LADYBIRD—Why so called—The Hopfly and the Ladybird.

WE now come to a tribe of wood-boring beetles, some of which attain large size even in this country, while under tropical skies they are of very great dimensions. These insects are well known under the name of Longicornes, or Long-horned Beetles, and are so called on account of the length of their antennæ. The first and most important family of this group is that which is called Prionidæ, from a Greek word signifying a saw, because the joints of the long antennæ are so formed as to present a series of saw-like teeth.

The females of the Prionidæ are furnished with an instrument which enables them to lay their eggs in cracks and fissures of trees, so that when hatched the young larvæ may at once find themselves in safety and in proximity to their food. In one species, the GIANT PRIONUS, the eggs are quite as large as those of the tomtit, but are much longer in proportion to their width.

The GREAT PRIONUS (*Prionus coriarius*) is the largest British wood-boring beetle, and, as may be seen by the illustration, is of no contemptible dimensions.

The larva of this insect is broad, flattish, and white, the rings being very deeply marked, and the body decreasing gradually in size from the shoulders to the tail. The jaws are small, but strongly made and of enormous power, their form being triangular, and the muscles which move them being very large and firm.

As it never leaves the tree as long as it remains in its preliminary stages of existence, the larva stands in no need of limbs, the legs being extremely small, and almost useless for locomotion. When the creature desires to move along the tunnel which it cuts, it does so by means of the projecting tubercles upon the larger rings of the body, which it applies to the sides of the hole, and which stand in the stead of feet. The hole which this larva makes is a very large one; and as the creature lives for some time within the tree, it makes no small havoc before it is ready to resume the perfect form.

Hitherto, the larva has been careful to avoid the sides of the tree, carrying its tunnels deeply into the wood; but, when it feels the time approaching when it is to cease from feeding, and to enter the outer world which it has never seen since it was hatched, it turns its course directly to the circumference of the tree, and, having cut its way nearly through the last layer, awaits its last change in a wonderful cell of its own construction.

This cell is of an oval shape, and is made of fragments of wood gnawed from the tree, and arranged in a very ingenious manner so as to defend the creature while it lies helpless in its pupal state. Here it remains for some time, the long antennæ being laid along the thorax; and when at last it emerges from the pupal skin, and takes rank as a beetle, it has only to bite away the few remaining obstacles, and then finds itself in the wide world. It is not much of a rover, at all events by day, and may be found clinging to the trunk of the tree in which it was bred, as is the case with many wood-boring insects. When thus settled on the tree it is not very easily seen, as its colours are but sombre, and harmonize so well with the brown bark, that a tolerably practised eye is required for its detection.

It has been said by Lacordaire that the large South American species are accustomed to saw off the branches of trees by their mandibles; and his assertion is corroborated by the experience of Mr. Waterton, who has shown me a severed branch which fell on his head while he was under the tree on which it grew. The branch is preserved in his invaluable museum. The beetles of the genus Prionus may be known by the toothed thorax.

THERE is a very pretty insect belonging to the next family, the Cerambycidæ, which is well known under the title of WASP BEETLE (*Clytus arietis*), because, as it moves in and out of the foliage, its yellow banded body, long legs, and peculiar gestures give it a very waspish appearance. This insect is very annoying to gardeners, on account of the destruction which it works among wooden palings, boring them through and through, and reducing them to such a state of weakness and rottenness, that an apparently stout post will crumble to pieces in the fingers if rudely pressed.

The larvæ are curious little objects, white, rather flat, very wide across the fore part of the body, and with a small, but stout, horny head. They may be obtained in any numbers by looking for old posts which display such signs of damage as a little sawdust on the exterior. If the bark of such posts be pulled off, these grubs will often come tumbling down by dozens. They may be secured without any difficulty, the only necessity being that a piece of the wood in which they live should be taken in order to afford them nutriment. They should, if possible, be placed in a vessel closed with wire gauze, as they are powerful beings, and will bite their way through gauze without the least hesitation. Even after they have attained their perfect state they are wonderfully strong, when the slenderness of their body and limbs is taken into consideration, and certainly would not remain very long in a prison where silk gauze formed the only obstacle to their escape.

In my own opinion, this is one of the prettiest beetles of which we can boast, not for any peculiar brilliancy of colour, but for the elegance of its form, and the simple but effective arrangement of the tints with which it is decorated. The head and thorax are black, the latter being very globular, and having a narrow ring of yellow at its junction with the head and the abdomen. The wing-cases are deep, rich chestnut, with yellow tips, a straight bar of the same colour about a fourth of their length higher up, and then a gable-shaped mark still higher. Just at the very bases of the wing-cases, and in their middle, is a little yellow spot, and a very small transverse line, of the same colour, is drawn across each shoulder. Below it is black; but each segment of the body is marked with a narrow line of yellow. The limbs are pale chestnut, and the antennæ are of the same colour, perhaps a little darker in tint.

June is the best month in which to find these beetles in full life and activity. They may be found either upon the posts in which they were bred, or crawling about on the adjacent hedges, ever on the move, skipping in and out of the foliage in a quietly active manner that seems peculiar to them.

THE well-known MUSK BEETLE (*Cerambyx moschatus*) belongs to this family, and is, indeed, the typical species. Almost every one knows this beautiful beetle; large, long-bodied, long-horned, richly clad in shining green, and imbued with a pleasant sweetbriar kind of odour, not in the least like musk.

This insect is very injurious to the willow, especially while it is yet young, for its larvæ are large and very voracious grubs, and cut the tree to pieces, as if it had been a piece of floating timber attacked by the ship-worm. Sometimes the entire trunk of a tree will be perforated with its tunnels, which are large enough to admit a common black-lead pencil, and penetrate to a very great depth. Indeed, a section of a tree which has been attacked by this insect displays a wonderful amount of devastation, the tunnels running in all directions, and mostly choked up with the sawdust-like remains.

It is not much of a wanderer, and remains upon the willows for days together. Still, it has a pair of large membranous wings, and, if it chooses, can fly well. In my "Glimpses into Petland," the reader will find a more lengthened account of this beetle, together with an account of a specimen which I kept alive for some time.

Closely allied to this insect is the SALLOW BEETLE (*Cerambyx* [or *Saperda*] *Carcharias*), a brownish insect, rather more stumpy than the Musk beetle. This insect is very destructive to the sallow, boring into the branches, and eating out all the pith. Some years ago it was very plentiful in Whittlesea fens, but since the drainage of that locality has been in operation it has become much scarcer.

Another allied species is the ASPEN BEETLE (*Cerambyx* [*Saperda*] *populnea*). This is a more elegantly-shaped insect, dark brown, approaching to black in colour, and diversified with buff dots. This insect attacks the young shoots of the aspen, boring into their interior, and causing a number of large knobs or swellings to appear, just as if the branch were afflicted with gout. Sometimes there will be five or six of these protuberances on a single stalk.

Fortunately for the proprietor of the trees, there is a fly, something like a bluebottle, but of a grey colour, which is parasitic upon the larva, and is so indefatigable in searching for its prey, that, in places where it has once taken up its residence, more than half the grubs will be destroyed, and when the time comes for attaining the perfect form there will be more flies than beetles.

The cocoon which these insects make just before they resume the pupal form is really a pretty piece of workmanship. It is of large dimensions, compared with the size of the creature that makes it, and is formed of very delicate strips of wood, about three-quarters of an inch in length, woven together in a rather curious fashion. A specimen in the British Museum has a remarkably neat effect, from the fact that the cocoon is made of light-coloured wood, and is made in dark brown bark, so that the contrast of the wood-fibres with the deep brown bark is really pretty.

Other species of this genus feed upon the pear, the nut, and the plum, attacking them in the same manner as is employed by the aspen beetle, and boring into their young and tender twigs, so as to allow the larvæ to feed upon the pith. The *Saperda cylindrica* is among the worst of these destroyers.

Some damage is also done to fir-trees, even after they have been felled, by the larva of a beetle called *Callidium violaceum.* It gets under the bark, and then gnaws its way in all directions, mostly remaining near the circumference until it is about to change into a pupa, when it bores directly into the body of the tree, and there undergoes its metamorphosis.

Perhaps the most extraordinary of all these beetles is the *Callidium bajulum*, which, like the wasp beetle, is destructive to posts and rails, but carries its injurious habits to a still greater extent. It does not content itself with the mere posts, but attacks the rafters of garden houses and sheds, and has even been known to bore its way through the leaden roofs, leaving circular apertures to mark its progress, and rendering the whole roof pervious to water. Excellent coloured figures of insects belonging to the above-mentioned genera may be found in Ratzeburg's "Forst-Insecten."

THE little beetle which stands next on our list, the ASPARAGUS BEETLE (*Crioceris asparagi*), is very injurious to the plant from which it has derived its popular name.

It does no harm to the asparagus while it is yet young, and in the state when it is thought fit for the table, but when it grows up, and is formed into that most graceful vegetable plumage with which we are so familiar, the insect is found plentifully among the feathery leaves, both in its larval and perfect conditions.

The larva is a curious little creature, and when once seen can never be forgotten. It is short, thick, and soft, very much wrinkled, small towards the head, and increasing in size to the latter third of the body. Its colour is ashen grey, with a few black spots. It is very sluggish in its movements, crawling very slowly, and remaining for hours together without moving. It has no means of defence, but when it is touched, or alarmed, a black fluid is poured from the mouth, and may possibly have the effect of deterring some of its enemies.

The legs are well developed, and a pair of rather powerful false legs are placed at the end of the abdomen. Indeed, the creature needs some powerful means of support, for the plant on which it feeds is so beautifully delicate, and is waved so violently by the wind, that, unless the larva were gifted with strong limbs, it would be hurled to the ground at every gust of wind. A series of small tubercles runs along the abdomen, and these are also used as legs, though they do not clasp the leaves so firmly as the false legs.

A close examination of the plant will often detect the eggs, which are affixed by one of their ends; and sometimes one egg is fastened to another in a manner which reminds the observer of the pretty eggs of the purpura, so plentiful in rock pools by the seaside.

The perfect insect is a remarkably pretty creature. The head is black and the thorax a ruddy chestnut, with a small blackish patch on the centre of the upper surface. The wing-cases are rich yellow-brown, with a jet black spot upon each shoulder, a black bar drawn nearly across the middle, and another black bar close to the tips. Below it is deep green-black.

Most of the species belonging to this family are adorned with beautiful colours. All the species of *Donacia*, for example, are decorated with rich bronze and green hues of a metallic brilliancy. These insects, however, can hardly take rank among our garden friends or foes, unless we include a fish-pond or a fountain in the garden, inasmuch as they mostly feed upon aquatic plants, the larva living within the stems.

Another species of this genus, *Crioceris merdigera*, deserves a passing notice. It feeds upon the lily and other plants of the same order, and may, therefore, be ranked among the foes of the garden.

The eggs of this insect are laid upon the leaves of various lilies, and as soon as they are hatched the young beetles commence their destructive labours. At first they are tolerably sociable, and feed in company, but as their dimensions and appetites increase, they are perforce obliged to separate, in order to obtain a supply of food. They eat the parenchyma of the leaf, and after the nourishment has been extracted from it, the refuse, instead of being dropped, as is the case with almost all creatures, is piled upon the back, in such a manner as to form a covering, which quite conceals the larva from sight. Perhaps one object of this remarkable arrangement may be to protect the creature from the rays of the mid-day sun. This strange shield does not adhere to the body of the larva, but can be thrown off at will.

Strange as this adaptation may seem, it is not without its parallel even among the insect tribes, as will shortly be seen, when we treat of the Cassida and its habits.

In the insect which is so widely known as the Black Flea, or Turnip Flea (*Haltica nemorum*), the agriculturist sees one of his worst enemies.

Although this insect is called a Flea, it is in reality a beetle, but has earned its popular title from the manner in which it jumps and skips about. The power of its hind limbs is really astonishing, and few persons would conceive, on looking at this tiny insect, that it can leap to so great a height. On a closer examination, it will be seen that the thigh of the hind leg is enormously thick and powerful; but even when that structure is inspected, the means appear to be totally inadequate to the effect.

This leaping power is chiefly used in escaping from enemies. Whenever it is alarmed, the little beetle leaps from the leaf on which it is crawling, and allows itself to fall to the ground, where it lies motionless until it thinks that the danger has passed away. As the under surface of the body is black, and it mostly contrives to lie on its back, so as to conceal the two yellow stripes upon the wing-cases, it can scarcely be discovered even after the closest investigation.

I well remember how, as a little child, I used to catch these beetles, and amuse myself by seeing them leap about, thinking only of the amusement which they afforded, and having no conception of their importance in an agricultural point of view. And so strongly do childish prejudices take a hold upon the mind, and sway our ideas independently of reason, that even now, with a very accurate conception of the harm which these beetles work to the agriculturist, I cannot but feel a strong affection for the pretty little active yellow-striped insects.

The Black Flea does but little harm to the flower garden, but in the kitchen-garden, and among the turnips, it runs riot like a wolf among sheep. No sooner do the first leaves of the turnip push themselves above the ground, than the Black Flea comes and lays its eggs upon them. That turnip is doomed, and the little insignificant creature, scarcely larger than a pin's head, has destroyed it as effectually as if it had been cut out of the ground with a hoe. As soon as the eggs are hatched, an event which usually occurs on the second day after they are laid, the young grubs begin to burrow into the tender leaf, and establish themselves between the layers, so as to feed on the soft parenchyma that lies between them. On account of its minute dimensions, it finds ample space even in these narrow limits, and moves about inside the leaf, eating a passage for itself, that widens in exact ratio to the growth of the grub.

In the leaf it remains for about fifteen or sixteen days, when it ceases to feed, makes its way out of the hospitable leaf which has for so long afforded it food and shelter, and falls to the earth, in which it buries itself. It lies thus hidden for thirteen or fourteen days, and then emerges from the earth a perfect insect.

Only the young and tender leaves of the turnip are attacked by this grub, and when the plant has once succeeded in attaining its well-known rough leafage, it is safe from this insect. Not only turnips fall victims to this insect, but the beetroot, the mangold wurzel, and the flax are liable to its ravages; and even the radish, so grateful on a warm summer's evening, does not escape.

The devastation wrought by this individually minute but collectively gigantic insect is in some years equal to that which is caused by the turnip sawfly, the parent of the "nigger" caterpillar, of which we shall presently treat. The insect is so small that it cannot be individually attacked; its larva lies hidden in the leaf and its pupa in the earth, so that hand-picking is quite useless, and, in consequence, it has been permitted to work its own destructive will unchecked by the ingenuity of man.

Yet there is a remedy for every evil; and even for such an unmitigated evil as the Turnip Flea there are several remedies, which have a good though partial effect; and it is not unlikely that some plan may be discovered for effectually checking the increase of this troublesome insect, which is so prolific that five or six broods are produced in each season.

It can certainly be drowned out of the garden, provided that water can be laid on in sufficient quantities, and there are facilities for securing the water so long as it is wanted and letting it off when it has done its duty. Also, the insect can be baked out of the garden, either by a hot and dry season, or by burning refuse vegetables upon the ground. In either case the pupæ are all killed, as they lie just beneath the surface of the ground, and the presence of a future brood is at once prevented. But as there are few gardens which will admit of either remedy, other plans must be tried.

In the first place, it may be received as an axiom that it is comparatively useless to make war against the perfect insect. You may do so with great success, and kill thousands of them, but their hosts are so vast, that the subtraction of a few thousands would be scarcely felt. It is of course right to catch and to kill the Black Fleas, and one that has been captured ought never to be allowed to escape. They may be taken in great numbers by drawing tarred canvas over the affected plants, but in most cases the mischief will be already done. But the place of those which have been destroyed will be speedily taken by fresh swarms, for the insects have tolerably powerful wings, and are led by their instinct to scent afar off the plants on which their eggs are to be laid. They will even make their way against the wind.

Perhaps the most effectual remedy is to scatter gas-lime upon the ground and over the plants. The odour of this substance is sufficiently disagreeable to man, but to the insect tribes it is more than disagreeable—it is fatal to them. If this precaution be taken in due time, the Turnip Flea will not venture near the plants.

Some persons think that the effect of the gas-lime is due to the fact that its scent is stronger than that of the turnip, and that it thus prevents the beetle from discovering where the turnips are growing. Yet the radish, which gives out scarcely any odour, is attacked by this beetle; and the fact that it will even fly against wind to the turnip-field shows that it is led by something beyond the ordinary sense of smell. I have no doubt that if the gas-lime had an odour ten times as strong, and were yet innoxious to the insects, the beetles would be found as plentifully on the plant as if no precaution had been taken.

The gas-lime has, too, another advantage: it receives and kills the full-grown larvæ as they attempt to descend into the ground; destroys the pupæ when the rain washes any of its particles against their tender bodies; and even if the insects should escape these manifold dangers, they will yet be obliged to push their way through the lime as they emerge from the ground, and so expose themselves to all its deadly powers.

It is said that if the gardener will rub his turnip-seed, before sowing it, in a mixture of linseed oil and flour of sulphur, the Turnip Flea will not attack the plants when they grow up.

After the crop has been gathered, it is a good plan to dig the ground carefully and deeply, throwing all the earth from the surface to the very bottom of the spit. The pupæ that have succeeded in burying themselves are thus deprived of air, and perish; or even if they do pass into the perfect state, the superincumbent mass of earth is too thick and heavy for them to make their way to the surface.

The colour of this insect is a shining black, with bronze reflections, and along each wing-case is drawn a broad bar of pale yellow. The larva is very minute, long and slender; and in order to enable it to crawl through the tiny galleries which it forms, it is furnished with six very short, but sufficiently powerful limbs. Some authors say that the whole of the transformations of this beetle are accomplished within the leaf. In some parts of the country this species is known as the BLACK JACK, though the pretty yellow bands which are drawn along the wing-cases might be expected to have earned a different and more expressive title.

The genus to which this insect belongs is an enormously large one, no less than one hundred and twenty British species being comprised in it.

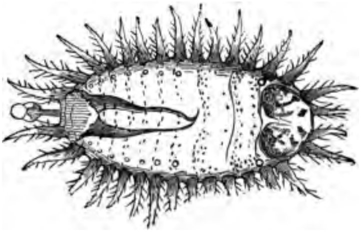
Other members of the family in which the Turnip Flea is placed—namely, the Galerucidæ—are injurious to different kinds of vegetation. *Haltica oleracea*, for example, is often extremely injurious to the vines, though in England its devastations are not so notable as in France and other vine-growing countries. In the year 1837 the vines in the neighbourhood of Montpelier were so damaged by the attacks of this little insect, that public prayers were instituted and religious processions organized for the purpose of checking its ravages. Not only the larvæ, but the beetles themselves attacked the plants; for it must be remembered that in both these stages does the Haltica feed upon the plant, the larva burrowing inside the leaf and the beetle eating holes through it.

A species belonging to the typical genus of this family, *Galeruca calmariensis*, attacks the elm. The eggs are laid along the leaf-ribs and are affixed by one of their ends like those of the asparagus beetle already mentioned. The larvæ soon begin their work of destruction, and in some seasons the insects have appeared in such vast numbers that the trees have been well-nigh stripped of their leaves.

On the leaves of many plants, but more especially on those of the artichoke, may be seen a very remarkable insect, which is popularly known by the very appropriate title of Green Tortoise Beetle (*Cassida viridis*). This insect belongs to a genus all of which are notable for the singular development of the thorax and wing-cases, which are spread into a kind of shield under which the limbs and head of the insect are protected, like a tortoise beneath its shell. When this beetle is at rest upon a leaf it is hardly visible, the green surface of the body harmonizing with that of the leaf, and the shape being so unobtrusive as to resemble a casual swelling in the leaf rather than a beetle.

This insect must rank among our garden foes, as the larva feeds upon the common artichoke (*Cynara scolymus*), not the plant which is popularly known by the name of Jerusalem artichoke (*Helianthus tuberosus*).

The whole development of this insect is so remarkable, that its depredations may be forgiven on account of the interesting habits which it displays. The larva is a flat, strange-looking grub; its body is surrounded with spines, and upon its back it bears a long, forked apparatus, originating from the tail and directed towards the head. I have already stated, when treating of the Crioceris, that it was not the only insect which was accustomed to protect itself in the curious manner there described. The excrements of the larva, instead of being totally rejected, are received upon this forked apparatus and there formed into a tolerably solid mass, which is held over the body and serves alike to conceal it from view and guard it from the hot sunbeams. When the fork is overloaded, the larva can throw off the heavy mass and is then ready to commence the formation of another parasol.



SKIN OF CASSIDA.

The fork is thrown off when the insect enters the pupal state, though even in that condition it is a very remarkable creature, being still surrounded with spines, and having a very wide thorax, entirely covering the head. The cast skin of the larva exhibits the fork in an admirable manner, and if properly mounted for the microscope it forms a really valuable object.

We now come to a family of very handsome, but very mischievous beetles, appropriately called the Chrysomelidæ, a term composed of two Greek words signifying golden apples, and given to these insects in allusion to their rounded bodies and the metallic brilliancy of their surface.

The aspen is much troubled with one of these beetles (*Chrysomela tremulæ*), a pretty insect, with a deep blue-black thorax and dark chestnut elytra or wing-cases. This insect eats the whole of the soft substance of the leaf, rejecting only the vein-like fibres; and so completely does it devour the foliage that it leaves only a mere bare skeleton, like those beautiful preparations of leaves which are obtained by maceration in water and washing away the softer parts. The leaf dies and falls soon after the beetles have left it, and in some places the insects have been so plentiful that whole trees have been stripped of their leaves as if by the winter's wind.

Many of these beetles emit a dark-coloured fluid when alarmed, and in some parts of the country it is thought that this fluid has the property of curing toothache. All that need be done by a person suffering from this torturing complaint, is to bruise one of these beetles between the fingers until the skin is well imbued with the liquid, and then to rub the finger upon the gums and teeth near the spot where the pain declares itself. It seems a strange and inexplicable remedy, but it would hardly have prevailed over so large an extent of country and survived for so many generations were there not some truth in it. Whether the liquid secreted by these insects really possesses any healing power, or whether we are to ascribe the cure to that very convenient remedy, the imagination, there is no doubt but that the toothache really is mitigated if not cured by its use. One species is in such favour for this purpose that the specific name of odontalgicus has been given to it, the word being of Greek origin, and signifying the toothache.

The sallow is much eaten by another species of this genus (*Chrysomela populi*), and the alder by the *Chrysomela alni*, a beautiful species of a dark shining blue. All the members of this genus possess well-developed wings. The larva of this beetle is a rather odd-looking grub, greenish white in colour, spotted profusely, and notable for the large projecting tubercles on the wings, which afterwards are blended together and form the thorax. The other segments of the body are furnished with tubercles, but of a much smaller size. The legs are rather large and well developed. When alarmed, the larva pours out a large quantity of dark fluid from its mouth and the joints of its legs.

The pupa is a curious-looking object, rather small, and having the cast skin of the larva gathered into a mass at the end of the body, just as a stocking is gathered into folds when pushed down over the foot instead of being drawn off.

I may here mention that the well-known insect called the BLOODY-NOSED BEETLE (*Timarcha tenebricosa*) belongs to this family, and is remarkable for discharging a very great amount of deep red fluid when alarmed. The larva of this insect bears a kind of resemblance to the perfect beetle, so that it is easily recognised. It is rather a large, fat, soft-bodied grub, of a dark, shining, green colour, with a much-wrinkled skin, and may be found plentifully in the herbage under hedges. It is a very slow-moving creature, and, as a general fact, it is motionless when discovered, and will remain in the same position for hours, or, at the most, will just slowly creep forward for the tenth of an inch or so.

This beetle has well-developed wing-cases, hard, convex, and firmly soldered together along their junction. They are very large, and if the beetle be turned over, they will be seen to overlap the wider portions of the sides in a very curious manner. But there are no wings, and this is acknowledged to be the largest wingless insect in England that feeds upon leaves. Its colour is extremely dark black-green, and the surface is dull, like that of "oxydized" silver.

THE last family of Beetles now comes before us in that which is scientifically known by the name of Coccinellidæ, and popularly by the title of LADYBIRDS, LADYCOWS, &c. Perhaps the general public is not aware that these titles are remnants of the old times, when the religion of Rome was the only system of Christianity, and that these insects, being supposed to be under the special protection of the Virgin Mary, were honoured by her name. They were called the Birds of our Lady, the Cows of our Lady, just as in France they are still known by the titles of *Bêtes-de-la-Vierge*, or *Vaches-à-Dieu*, and other similar appellations.

I am glad to be able to state that these, the last of our Beetles, are an unmitigated benefit to the gardener, and that without exception they should be protected as his best friend. In their perfect state they are almost neutral, but in their larval condition they may take rank among our best friends.

Every one who has possessed a garden, or even a backyard, or is forced to content himself with a few plants in the window, has been annoyed by seeing his cherished plants injured and their growth stopped by the green flies, or aphides, which make their appearance as if by magic, and seem to increase in numbers almost hourly. These mischievous little creatures drive their beaks into the soft tissues of the plant and suck out the juices which ought to have gone towards the development of the leaves and flowers. On these aphides the larva of the Ladybird feeds, and is as industrious in destroying them as they are in destroying the plant.

Wherever the aphides assemble, there the Ladybird is sure to follow. In the midst of the green or black swarms she deposits a patch of tiny yellow eggs. In a short time these eggs are hatched, and the young larva is thus at once in the midst of the creatures that serve as its pasturage.

These larvæ are not at all unlike those of the Chrysomela, as may be seen by a reference to the illustration; but they differ from that creature by proving themselves our valued allies instead of inveterate enemies. No sooner are they hatched than they begin to devour the swarming aphides, and they have such very excellent appetites, and labour so incessantly at this pleasing occupation, that they more than counteract the rapid increase of these insects. In some parts of France, the gardeners are so well aware of the valuable services rendered by this insect, that they take care of every Ladybird which they can find, and place it upon some greenhouse plant.

Those who like to keep the hop-plant in their gardens, and can appreciate the wonderful grace of its luxuriant foliage, have every reason to be grateful to the Ladybird, and to repay their services as far as possible, by extending to them the protection which they so well earn.

In the hop-grounds the Ladybirds are to be found in vast numbers, feeding upon the aphides, which, under the popular name of "the fly," are so terribly destructive to these capricious plants. The author of "Annals of our Village" remarks of the Ladybirds :—"Such is the havoc they occasion, that it is calculated that one of these little amazons will destroy thousands and tens of thousands to her share. Their arrival is, therefore, anxiously expected by the hop-growers, who employ boys to drive away such birds as feed upon them. Wherever the wild or cultivated hop is found, thither the Ladybirds repair ; we have the former in our lanes, and I have sometimes seen the asparagus beds nearly covered with the gay-coated insects, at which time we always hear of their being abundant in the hop countries.

"During the hot summer of 1807, the southern coasts were literally covered with troops of Ladybirds, which had emigrated from the neighbouring hop-grounds. The visitors, unused to their appearance, regarded them with some little degree of surprise, and a few considered them as precursors of calamity. Sidmouth was also visited with a numerous flight in the summer of 1827, and it was amusing to observe the predilection they evinced for different colours. Such ladies as wore green were spangled with them, but very few were observed to settle on a fawn-coloured dress." In one place, where vast swarms of Ladybirds had shown themselves, the farmers were so frightened that they actually sent for the parish fire-engines in order to deluge the insects with tobacco-water.

The remark concerning the alarm of the visitors is a very curious one, and finds a parallel in many another cases. In some parts of the country, where the plants were terribly ravaged by the aphides, and the Ladybirds came in swarms to kill them, the ignorant agriculturists, struck by the more conspicuous Ladybirds, and overlooking the smaller and less evident aphides, sagaciously considered the former insects as the cause of the devastation, and persecuted them accordingly, though each Ladybird was, as the saying is, money to the farmer.

When the larva of the Ladybird has eaten all the aphides which it can manage, and has grown to its full dimensions, it fastens itself to a leaf by the extremity of the tail, and then the larval skin splits and discloses the pupa. Mr. Westwood mentions that in one species (*Coccinella maculata*), which he found in great numbers near Sèvres, feeding upon the common wild bryony, the larval skin is not thrown off, but merely opens along the back, and allows the pupa to receive the benefit of light and air. It remains in the pupal condition about twelve days or a fortnight, and then passes into the condition of a perfect Ladybird.

The Ladybirds possess the power of emitting a dark liquid, whenever they are alarmed or handled; and this substance is thought to possess equal efficacy in curing the toothache with that which has already been described as proceeding from the chrysomela.

Many species of Ladybirds inhabit England, most of which are named from the number of spots which they bear. They are, however, the most variable of insects, and almost every species is liable to differences of colour, which in any other creature would afford ample grounds for constituting new species. The common Seven-spotted Ladybird is, perhaps, the most constant in colour; but others are liable to such extraordinary variations, that their correct arrangement is one of the most difficult tasks which the entomologist can undertake. Thus, some specimens of the Twenty-two-spot Ladybird have the normal number of spots, while others have eighteen, others sixteen, others twenty, others four, others thirteen, others six, and others no spots at all.

There are thirteen varieties of another species—many have nine or ten acknowledged varieties; while one species, the Two-spot Ladybird, is so extremely variable, that, whenever the entomologist finds a Ladybird which he does not know, he is mostly safe in putting it down as a variety of the Two-spot. Sometimes this species is of the well-known red colour with which the common species is tinted, and has two little black spots, one on each wing-case, and sometimes it is deep black, with a gleam of red upon its upper surface; sometimes it has four large patches of black, and sometimes it is mottled, leopard-like, and has been ranked as a species under the name of *Pantherina.*

I have a great number of Ladybirds in my cabinet, containing many varieties; but the task of arrangement is so difficult, that they remain without being named, some of them having been caught fifteen or sixteen years ago.

The second example of Ladybird which is figured in the illustrations is notable for being the largest British species of this genus. In colour it much resembles the ordinary Seven-spotted Ladybird, but may easily be distinguished from that insect by the two very large round black spots upon the wings.

CHAPTER XV.

Dermaptera, or Earwigs—Their Resemblance to the Staphylinidæ—Their Wings—A Misnomer, and a General Superstition—Needless Alarm—The Tail Forceps, and their Uses—Habits of the Earwig—Earwig Traps—Injuries to Flowers—Nocturnal Search—Maternal Affection—Flight of the Earwig—Development of Insects—A Question answered.

Leaving the Beetles, we come to a small order of insects which are often taken for the Coleoptera, and certainly bear nearly as much resemblance to that order as do the Staphylinidæ, of which we have already treated.

The Earwigs are ranked under a separate order by the name of Dermaptera, or skin-winged insects, because their wing-cases are soft and leathery. Mr. Westwood, however, bases his arrangement not upon the wing-cases, but upon the wings themselves, and calls the order Euplexoptera, *i.e.* the beautifully-folded winged insects. The title is certainly a just one; for, perhaps, in the whole range of the insect tribes there is not one example where so large and gauzy a wing is folded into so small a compass, and in so exquisitely simple and elegant a manner.

The wing, when expanded, is of a fan-like shape; and a good idea of its action, when folded, may be formed by closing a fan, and then supposing that the ribs were furnished with hinges, so as to be doubled over upon themselves. It will be seen then that the large fan would be packed into a very small compass; and very similar to this plan is the mode that is adopted in the wing of the Earwig. Indeed, their name is a misnomer, or rather a corruption; for the word was originally Earwing, in allusion to the resemblance between the human ear and the wing of the insect. Ignorant people, however, misled by the name, have an idea that the insect crawls into the ear, and, unless destroyed, gets into the brain and causes madness, after inflicting intolerable agony upon the sufferer. It is strange that this absurd idea should have been accepted so widely as is the case. In almost every country in Europe this insect is thought to creep into the ear, and in almost every modern European language its name bears reference to this imagined custom. The French, for example, know it by the name of "Perce-oreille;" the Germans call it "Ohren-wurm;" and the Swedes know it under the title of "Ōren-wetel."

Many of my readers have, in all probability, seen such accounts in books, with advice as to the best method of killing the insect, by pouring oil into the ear. The remedy would certainly be effectual; but as an Earwig, if it did by any mischance creep into the ear of a human being, would only be too glad to get out again, it is rather unnecessary.

This insect excites much alarm and disgust in the minds of many people, especially among ladies, who seem to dread it as much as if it were a wasp or a hornet. This alarm is quite needless; for although the insect can inflict a rather smart pinch with the curved forceps which it carries at the end of its tail, it is perfectly harmless to human beings, and only uses its forceps for the purpose of folding up its wings and tucking them under their little square covers.

To the entomologist, the Earwig is a most interesting insect, but to the gardener it is an uncompromising enemy; and when flowers begin to show their many-coloured petals, its jaws make no small havoc among them. To keep these insects from the flowers is a hopeless task, for their beautiful wings can carry them from one plant to another, and overpass all defences; so that the only plan which can be adopted with any hope of success is to catch and destroy them whenever such a proceeding is feasible.

Earwigs are eminently nocturnal insects. With the exception of some of the smaller species, they do not fly by day, and at the early dawn they retreat from the unwelcome sunbeams, and hide themselves in every cranny. They may be found concealed among the petals of flowers, especially in such examples as the dahlia, where they can obtain deep shelter from light and heat. The flower of the nasturtium is a very common residence of these insects; and in my juvenile days I have more than once bitten an Earwig which had concealed itself in the long, hollow space of the fragrant flower. They also are fond of crawling along leaves which partially envelop the stem at their bases, and, thrusting their heads into the farthest extremity of the crevice, lie there motionless during the day. They may be found plentifully upon standard roses by searching under the matting that ties the stem to the stake, or hidden in the forks of the branches. I had hardly written these sentences, when, on going into the garden and opening some folded labels which had been attached to sticks marking the spots where certain seeds are sown, I found them mostly tenanted by Earwigs, which were lying very snugly ensconced within the paper.

These habits, although they certainly are effectual in hiding the insect from inimical eyes, are yet made the means of decoying it to destruction. Nothing is easier than to catch the Earwigs, and their numbers may be greatly thinned at the outlay of a little trouble.

Every one has seen the inverted flower-pots on stakes which are used for the purpose of catching Earwigs, or the lobsters' claws which are so much in vogue in suburban gardens, and which are very much admired by that class of the community which papers the walls of its rooms with representations of railway stations or hunting scenes, paints its window-blinds with the battle of Inkermann, puts a peacock on its hearthrug, strews bunches of peonies on its carpet, and talks of its 'ouse. These Earwig traps are perfectly successful, but most obtrusive and unsightly, and may be replaced with snares quite as effectual and almost invisible.

Take a few sticks of elder, cut them into lengths of three or four inches, and push out the pith. Stop up one end with a paper or wooden plug, and there is the trap. Tie these tubes, with the mouth downwards, to the stems or stakes of the standard roses, just below the branches; to the stems of the dahlias where they are sheltered by the leaves; to the sticks which support the carnations, sweet peas, and similar plants; to the upright branches of the shrubs; and, in fact, fasten them in various places about the garden. A hundred of these traps may be employed, and yet a casual visitor will scarcely see one of them. They are even more effectual than the flower-pots, because they are smaller and darker, and are therefore more attractive to the insects.

Every morning the tubes should be taken down, the plugs removed, and the inclosed Earwigs shaken or blown or pushed into a vessel, in which they may be killed by pouring boiling water upon them.

Earwigs are very injurious to the petals of many of the flowers, nibbling them round, and rendering them quite unsightly. The gardener who has carefully been watching over some favourite flower with which he has hopes of winning the honours of the first prize is frequently disappointed of his hopes by seeing the beautifully rounded edges of the petals nibbled away, notched, grooved and wrinkled, and altogether ruined for exhibition. Such flowers as the dahlia, which depend so greatly for their value upon the smoothness and regularity of the petals, suffer sadly from the jaws of the Earwig, and need especial protection from its ravages.

As these insects feed at night, the gardener will find himself repaid if he examines his flowers once or twice in the course of the night by means of the bull's-eye lantern, which has already been recommended. A pair of entomological forceps, which can be obtained for sixpence or a shilling, according to the material and make, will bring them out of the smallest crevice into which they can creep, and will kill them at the same time if the thorax be seized and smartly pinched. In insects, the great mass of nervous matter lies in the thorax, and a blow or sharp squeeze is sure to kill them.

The whole tribe of pinks, carnations, clove-gilliflowers, and similar plants, are very liable to the attacks of the Earwig, which will also, in default of fresh petals, feed upon fruits, whether ripe or decayed. It is said that if the Earwig be kept without food for a considerable period, it will devour its own kind; but this assertion seems hardly to rest upon a firm foundation, and certainly does not prove the Earwig to be naturally carnivorous. It has, however, been noticed in the act of killing and eating the larvæ of the Hessian fly.

The eggs of the Earwig are laid in the ground, being placed either under stones or in some hollow which is made by the parent insect. They do not remain for any long period in this preliminary stage, but are soon hatched, and produce tiny, active little beings, very like the parent, having the forceps at the end of the tail, but no wings. The forceps, however, are comparatively small and imperfect in shape, and do not assume their hard consistency and boldly rounded curves until the insect has obtained maturity.

The mother Earwig is very careful of her young brood—nearly as careful, indeed, as is the common wolf spider (*Lycosa saccata*)—sheltering her offspring underneath her body, and even moving the eggs from place to place, so as to afford them the moisture which they need.

Very few have seen the Earwig in the act of flying, and to persuade the generality of persons that the insect has any wings is rather a difficult matter. The larger species never, as far as I know, flies by day, but the smaller kinds are not so intolerant of light, and may be seen, even at noon, flying about with perfect freedom. A practised eye, however, is needful to distinguish them from many long-winged flies which prefer the same hour for their aerial exercise.

Perhaps I may take the present opportunity of answering a question which has often been put to me regarding this insect. Some few years ago, I mentioned in my little work, the "Common Objects of the Country," that insects never grow after they have assumed the perfect form. This simple allusion to a fact, well known to all entomologists, produced a storm of letters impugning the truth of the assertion. Earwigs were the insects which were chiefly relied upon to disprove the statement, my correspondents all remarking that they had seen Earwigs of all dimensions, and that, therefore, Earwigs would grow.

Now, in the first place, there are in England several species of this insect, some small and some large, and therefore it is perfectly possible to see very small though full-grown Earwigs. In the second place, the larva and pupa of the Earwigs have, as has already been mentioned, a very close resemblance to a perfect insect, but can be at once distinguished by the absence of wings in the former state, and their undeveloped condition in the latter. Uninstructed observers would, however, be likely to overlook these technical, though important details, and then would believe, as many have done, that Earwigs formed one exception to a general rule.

MOLE CRICKET.—*Gryllotalpa vulgaris.*

CHAPTER XVI.

ORTHOPTERA—Why so called—The MOLE CRICKET—Its Singular Formation and Muscular Powers—Damages to the Garden—Its Habits—The FIELD CRICKET—Its Cry, and the Means by which it is produced—Use to the Garden—Its Irritable Temper—GREAT GREEN GRASSHOPPER—Its Colour and Appearance—Its Habits, and the injury which it inflicts—Its strange Voracity—A Silent Species—The GREY GRASSHOPPER: its Haunts, Habits, and Appearance—The WART-BITER—Origin of the Name—Strange Use of an Insect—The MIGRATORY LOCUST and its Habits—Locusts and Grasshoppers—The THRIPS—Its Ravages in the Garden and Greenhouse—Various Methods of destroying it—An unfailing Cure—Necessity for Caution.

PASSING onwards to the next order of insects, we come to the ORTHOPTERA, or straight-winged insects—namely, those insects in which the wings are not folded crosswise. In this order we include many familiar insects, such as the grasshoppers, crickets, and cockroaches, of our own country, and the wonderful long and walking-stick insects of tropical climates. Of these insects only a few typical examples will be given.

The strangely-formed insect which is termed the MOLE CRICKET is found in great numbers in some parts of England, though it is very local in its habits, and from some places seems to be entirely absent. Even in those localities where it takes up its residence it is seldom seen, though often heard, residing underground for the greater part of its existence, and only coming abroad by night. It prefers sandy districts to heavier soils, as the labour of digging is thereby lightened, and in such places may be heard uttering its curious call, which has earned for it the names of CROAKER and CHURR WORM. The popular title of the Mole Cricket is most appropriate, for the insect is shaped just after the pattern of the animal whose name it bears, the similarity of the general shape and the wonderful resemblance between the fore limbs of both creatures being too obvious to escape notice. The head and thorax are shaped so as to pass through the earth with as little resistance as possible, the eyes are small, but sufficient for the purposes which they are intended to fulfil, and the body tapers away towards the tail.

The limbs are stoutly and powerfully made, but the two fore legs are possessed of enormous strength, and, according to the observations of an experimental naturalist, can exert a force nearly equal to three pounds. Now, a man of average strength and of average weight, say, weighing between eleven and twelve stone, can lift about four hundred pounds—*i.e.* between two and three times his own weight. Assuming that the Mole Cricket weighs half an ounce, which is rather more than the true weight, we shall even then find that the creature is capable of working continually while exerting a force equal to more than eighty times its own weight.

The fore feet form the most remarkable points in this wonderful insect. When the creature is at rest they lie along the sides of the head, but when the insect begins to burrow they can be forced aside, as is shown in the illustration. Their broad palms are armed with powerful black, horny teeth, which correspond to the claws upon the toes of the mole, and are used in a similar manner. It may be readily imagined, by reference to the illustration, which represents a Mole Cricket of the natural size, how powerful an instrument is this limb, and how admirably it is calculated for tearing up and flinging aside the earth.

The base of the thorax and the limbs are covered with a clothing of dense, short, velvet-like hairs, which are analogous to the soft fur of the mole, and serve to prevent the soil from clinging to the surface of the insect. The whole under surface is thickly covered with this down, which there takes a warm yellowish hue, instead of the sober brown of the upper portions of the body.

At night the insect emerges from the earth, and takes to the air; and in order to enable itself to transport the stout, heavy body through so yielding a medium, it is furnished with a pair of broad and powerful wings, nearly straight along their upper edges, but taking a bold and graceful sinuation upon the outer and hinder edges. The nervures of the wings are very simple, but have a pleasing effect, consisting of straight, stout, radiating ribs, upon which the delicate gauzy membrane is supported. When the wings are closed, the long and stiff upper edges project far beyond the wing-cases, and extend even beyond the extremity of the body, as may be seen by reference to the illustration.

When these insects make their way into gardens, they work no small mischief, not so much by devouring the herbage as by mining the ground and distributing the seeds and roots of delicate plants. Still, the observant and accurate author of the "Natural History of Selborne" tells us that the Mole Cricket occasions great damage by destroying whole beds of cabbages, young legumes, and flowers. This havoc, however, might possibly be caused by the exertions of the insect while forcing a passage through the earth; for, while engaged in burrowing, it mostly remains so near the surface that it throws up a ridge of earth to mark the course which it has taken.

Its food may possibly be of a mixed kind, as is the case with many insects, for specimens kept in captivity would eat potato in preference to any other vegetable, but would reject everything for a piece of raw meat. Moreover, it was found impossible to keep these insects in company, for, unless they were very well supplied with the food which they liked, they used to fight with each other, and the vanquished combatant was always eaten by the victor.

Gardens along the sides of rivers and canals seem to be most liable to the inroads of the Mole Cricket, which sometimes takes advantage of the light and much-worked soil, and drives its tunnels in all directions through the flower-beds. The eggs of this insect are laid in the ground, within a curiously-constructed nursery. "There were many caverns and winding passages, leading to a kind of chamber, neatly smoothed and rounded, and about the size of a common snuff-box. Within the secret nursery were deposited near a hundred eggs, of a dirty yellow colour, and enveloped in a tough skin; the eggs long, but shallow, and within the influence of the sun." The insect is said to remain for three years in the larval and pupal states.

Very few species belong to this extraordinary genus; but it is a rather remarkable fact that these few species are found in every part of the globe, Java and Australia included. One species, which is found in the West Indies, is very fond of the sugar-cane, when young and tender, and commits great ravages among the plantations.

THE FIELD CRICKET (*Acheta campestris*) belongs to the same family as the mole cricket, and is very closely allied to the common cricket, with which we are so familiar. The noise which this insect produces is peculiarly loud and shrill. Some persons are very fond of this cry, and encourage the insect in their gardens for the same reason that they would encourage the nightingale or the blackbird.

As very few persons know how this sound is produced, and much curiosity is generally manifested on the subject, I will give Mr. Westwood's description of the organs which produce that sharp thrilling sound, which seems to pierce the very ears. After remarking that this sound is produced by the male insect alone, that eminent entomologist proceeds as follows:—"On the internal margin of the wing-cover, about one-third of its length from the base, a thickened point is observed, from whence several strong veins diverge, forming an angle from this point. The strongest of these veins, which runs towards the base of the left wing-cover, is found on the under side to be regularly notched transversely like a file.

"When the wing-covers are closed, this oblique bar of the wing-cover lies upon the upper surface of the corresponding part of the right wing-cover; and, when a tremulous motion is imparted to the wing-covers, this bar rubs against the corresponding bar of the right wing-cover, and thus produces a vibration, which is communicated to the other parts of the wing-covers; which, being divided into a number of irregular spaces, have each a distinct vibration, and produce a separate sound, which unitedly forms the stridulation or chirrup so well known."

This sound has been produced artificially by rubbing the wing-cases together, in imitation of the movements of the insect when living and in full cry.

The Field Cricket may lay claim to the honour of being received among our garden friends, being a great destroyer of insects, and especially of those which go abroad at night and for the most part are injurious to the garden. In the evening, the Field Cricket likes to sit at the mouth of its burrow, and catches such insects as are unfortunate enough to pass within its reach. It is, however, herbivorous in some degree, for it will eat various plants, provided that they be covered with dew or rain-drops. All these insects seem to be thirsty beings, and the Field and House Cricket are alike lovers of moisture. The Rev. G. White states that these insects can be kept alive by supplying them with plants constantly moistened; but that, if this precaution be not taken, the crickets will speedily die.

It is a very irritable creature, fighting desperately with others of its own kind, and biting fiercely anything at which it is pleased to take umbrage. So fierce, indeed, is its temper, that it can be captured by the simple process of pushing a grass-stem into its burrow. The insect is immediately seized with anger at the intruding substance, grasps it firmly with its jaws, and can be pulled up out of the hole before it will loosen its hold.

We now come to some insects that form an intermediate link between the crickets and the locusts. In all these insects the antennæ are slender and very long, the males have a talc-like spot at the base of the wing-covers, and the females are furnished with a projecting ovipositor—*i. e.* an instrument by means of which the eggs are placed in the proper localities. In these points the insects in question agree with the preceding family, but they differ in this point, that whereas the wings and their cases lie nearly flatly on the back in the crickets, in these insects they form an angle, and somewhat resemble the roof of a house, sloping on either side. The ovipositor is mostly flat, and slightly curved, like the blade of a cavalry sabre of the old pattern. They are all elegantly and delicately made insects, with very large gauzy wings.

One of the handsomest and largest of the Gryllidæ, as this family is termed, is popularly known by the name of the GREAT GREEN GRASSHOPPER (*Phasgonura* [or *Locusta*] *viridissima*). This beautiful species is about two inches in length, and of a delicate green colour. As is mostly the case with these insects, the green hues begin to fade almost immediately after death, and, passing through various shades of yellow, settle into an unsightly brown. I have often attempted to preserve the colours of this insect, but have never succeeded. Even the careful removal of the interior of the body and applying green paint will not produce the desired effect, and the entomologist is still obliged to content himself with most wretched and miserable mummies of this fine insect.

The Great Green Grasshopper is not so rare as is generally imagined. There is scarcely a year when the capture of one of these insects—which is, by the way, always called a Locust—is not recorded in some provincial journal, generally accompanied by a few remarks concerning the calamities which the Locust is likely to bring upon the country. Yet an entomologist would mostly engage to produce six or seven specimens on any given day, because he knows the spots where such insects are likely to be found. I used to procure as many as I liked from a garden on the outskirts of Oxford, searching for the insects in a hedge of tall hazel bushes that skirted one side of the garden.

These insects are seldom seen on the grass, preferring to take up their residence upon trees, where their green colours harmonize so well with the foliage that even a practised entomologist has some little difficulty in detecting them.

They feed upon the leaves of the trees which they frequent, and are enabled by means of their powerful jaws to slice a leaf as if with shears. Once or twice I have been careless enough to allow a Great Green Grasshopper to seize my finger in its jaws, and have been admonished of my imprudence by feeling the sharp jaws nearly meet through the skin and flesh of the finger, causing very severe pain at the time. They are voracious beings: Mr. Westwood mentions that on one occasion he had captured one of these insects which kicked off a hind leg, a feat which is not unusual among this class of beings. He placed the Grasshopper, together with the severed leg, in a box, and when he opened the box next morning found that the creature had eaten half of its own leg.

The wings of this insect are large and handsome, and when spread measure about three inches from point to point. The long ovipositor of the female is nearly straight, flat, and composed of several plates, just as if two sword blades were laid side by side and some dagger blades between them. When the insect wishes to deposit her eggs, she fixes herself firmly by her feet, and, bending the body, pushes the ovipositor deeply into the ground. She then passes an egg along this instrument, the blades of which open to receive it, and deposits it at the bottom of the opening.

Autumn is the time for this process, and the eggs lie in the ground until the succeeding spring, when they are hatched, and the little creatures emerge from the ground into the open air. They much resemble their parent in form, except that they have no wings and the females have no ovipositor, this weapon not developing itself until the insects are two months old.

The sound produced by this insect is extremely loud, and is continued until quite late in the evening. There is little doubt but that this cry is intended, like the unearthly ululations produced by our domestic cat, as a call to attract the female. In the latter instance, it is impossible to suppress a feeling of wonder at the taste which could feel itself attracted by such horrible dissonance. In the former, the chief point of interest is, that by means of this species anatomists have been able to prove that insects are gifted with auditory organs, and able to distinguish one sound from another—a faculty which has been boldly denied by many writers.

The female insect may easily be distinguished by the long and straight ovipositor, and the male may be known by the eyed wings and their covers, and the four short processes on the end of the abdomen. The generic name, Phasgonura, is composed of two Greek words, and signifies sword-tailed. It is given to this insect in allusion to the sword-like ovipositor of the female.

A smaller species, allied to the Great Green Grasshopper, is the insect which is scientifically known by the name of *Meconema varia,* the only species of its genus.

This insect may be found upon oaks, the fine green of its colouring harmonizing admirably with the peculiar tints of the oak leaf. This is a silent species, the wing-covers of the males being devoid of any stridulating apparatus. This is a much smaller insect than the preceding, but it is an elegantly-shaped and active creature, rather destructive to that much-enduring tree, the oak, which seems to afford food and shelter to a greater variety of insects in all their stages than is the case with any other tree.

The genus Meconema may be readily distinguished from the preceding by the absence of the eyed marks on the wings and elytra of the male, and by the two long curved processes at the end of the abdomen.

BEFORE we leave this family, we must glance at a couple of insects belonging to the same genus. The GREY GRASSHOPPER (*Decticus griseus*) is chiefly found in damp places, and loves to hide in marshes and boggy spots. It is therefore much inclined towards gardens that are kept carefully watered, and will sometimes be found in tolerable numbers. It is not, however, one of the swarming insects like its relations the locusts, and does, therefore, comparatively little harm.

It is a quick and very shy insect, loving to hide among long grass, and on the least alarm diving down to the very roots, so as to hide itself more completely. Like several others of its kin, it is fierce, quarrelsome, and courageous, fighting desperately when several are confined together in a box, and the victors, according to their cannibalistic custom, devouring the vanquished. It is possessed of a powerful appetite as well as strong jaws, and on account of the large amount of food which it can consume it has received the generic name of Decticus, or capacious.

The second species of this genus is called the WART-BITER (*Decticus verrucivorus*), so called from a very curious use to which it is put. In this country the insect is not common, but in many parts of Europe it is very plentiful, and is employed by the peasantry as an infallible cure for those unsightly excrescences. When a peasant is much troubled with warts, he catches one of these insects, and holds its mouth upon the wart. The Grasshopper being always ready to bite anything which seems to oppose its wishes, and being angry at the durance to which it is subjected, seizes the first object which it can reach, and bites vigorously, at the same time ejecting from its mouth a dark fluid.

By the united action of the bite and the fluid the wart is supposed to be destroyed; at all events, it vanishes in the mysterious fashion which characterizes the growth and disappearance of warts. The process, indeed, is evidently analogous to the wart "charming," so extensively practised in England by the lower orders, and so strangely effectual, in spite of the evident inadequacy of the means employed, and the totally different character of the methods used in various parts of the country.

As therefore, gardeners, like other human beings, are liable to warts, and may possibly be freed from these unpleasant protuberances by the friendly bite of the insect, we may include this creature in the number of the gardener's friends.

Like the preceding insect, the Wart-biter is very shy, and always ceases its cry at the slightest alarm. Insects of this genus may easily be distinguished by the broad forehead, by the long wings and their cases, with the eyed marks in the male, and by the long curved ovipositor of the female.

THE true Grasshoppers have no ovipositor, and the antennæ are comparatively short. They are nearly related to the well-known MIGRATORY LOCUST of the hotter parts of the world, and sometimes have been known to do great harm to the gardens.

So numerous are these insects in some parts of Europe, that a fixed scale of prices is published by the government for the eggs and perfect insects, and no less a sum than forty-eight pounds has been paid in one year by the city of Marseilles alone, for these insects. The eggs and insects are sold by weight, and a very small sum is paid for them, fivepence being the price for a kilogramme (rather more than two pounds avoirdupois) of the insects, and tenpence for a kilogramme of the eggs. The enormous number of the insects, and the necessity for such measures are sufficiently shown by these statistics.

The Migratory Locust (*Locusta migratoria*) has now and then been driven to our island, probably by the wind, and has occasioned some little perturbation in the minds of the numerous class of pessimists, popularly called croakers, who are sure to predict calamities from every uncommon event—who see "trouble inevitable" in the flickering waves of the aurora borealis, impending war in the last new comet, the decadence of England in every reform, and the downfall of religion in every science. There is no cause for alarm. The Migratory Locust thrives not in this country, and even if it could do so, there would be but small hope of life for one of these insects, when once it ventured into a country like this, where the hand of every one is against everything strange, where not a strange bird can flap its wings without being shot, not a stray whale wander to our shores without being killed or hunted out to sea again, and scarcely a strange insect appear without being caught by some entomologist who wants to place it in his cabinet, or killed by a rustic who is afraid of it.

There are more than twenty British species of Locusts, all of which are popularly massed under the general title of Grasshoppers, a convenient term which embraces the whole of two large families. None of them attain any large size, one inch being the general maximum of their length, and there are not many specimens that ever reach such dimensions.

We often see our flowers terribly disfigured by innumerable blackish spots, generally upon the under sides of the leaves. Greenhouse plants are especially liable to this pest, which ere long affects the well-being of the leaf, and causes it to lose its bright green hue, to turn pale, then yellow, and then to wither away. Those black spots are exudations from a very tiny insect called THRIPS, of which there are several British genera.

There is but one family of Thripsidæ in the orders the members of which are termed Thysanoptera, or Tassel-winged insects, because their wings are fringed with long hairs, which, when those members are closed, look like a couple of tassels. The wings are not folded in any way when at rest, but lie flatly along the back, one crossed over the other. They are all very minute insects, seldom exceeding the twelfth of an inch in length, and being very slenderly made.

These insects may be seen by thousands crawling upon our flowers, and even blackening their petals by their multitudes. Wherever they abound it is needful to take great care in gathering the flowers, for the insects crawl upon the hands, up the arms, and so traverse the body, causing an almost intolerable irritation as they run about. They have no sting, neither do they bite, but the mere movement of their limbs as they run nimbly to and fro, is so irritating, that the sufferer would be glad to compound for a few stings, if they would only cease their restless perambulations.

When the Thrips attacks a plant, it stations itself upon the under surface of the leaf, and begins to imbibe the juices by means of its short, conical sucker. It continually secretes a black fluid, which may be seen at the end of the tail, and which is strongly fixed to the leaf, producing the black spots which have already been mentioned. As the fluid is of a glutinous nature, it clogs up the myriad pores through which the leaf respires, and in process of time, fairly kills the leaf by choking it. Indeed, the whole process of destruction is just as if the human lungs were to be gradually obliterated, as is the case in many pulmonary disorders.

But the larva and the pupa may be seen upon the under side of the leaf, and the perfect insect is also fond of concealing itself in a like manner. There is but little hope of extirpating these tiny pests from the garden, as they increase so rapidly in their numbers, and pass so readily from one place to another, that a few thousands more or less make but little difference; but when they get into the greenhouse, as is their very unpleasant custom, they may be killed easily enough, either by scattering the insect powder upon the leaves, or, what is much better, by burning it in the manner that has already been recommended.

If, however, they should resist the effects of this remedy, there is one never-failing mode of killing them and every other living creature in the greenhouse. The greatest care, however, is required in applying this remedy, for it is as fatal to man as to insect.

Take a small pan with a little charcoal in it, ignite the charcoal and place the pan on the floor. As soon as it is fairly alight, take about half an ounce of the purest Cayenne pepper (the pods of the capsicum ground in a pepper-mill afford the purest kind) wrap it up in paper that has been steeped in a solution of nitre, lay it on the charcoal and leave the greenhouse at once. Every window should have been carefully closed, and every crevice stopped, and immediately on shutting the door, put a mat in front of the threshold, and, if needful, paste paper over every place whence smoke exudes.

As soon as the fire reaches the paper, it will consume with abundance of sparklets, and permit the pepper to fall among the glowing coals. Clouds of vapour will immediately arise, and every creature that breathes that vapour dies. If, perchance, the operator should inhale but the least breath of this terrible vapour, his throat will feel as if suddenly grasped by a giant hand, a spasmodic contraction of the larynx prevents all air from entering the lungs, and even after the symptoms have somewhat relaxed, the effects of this vapour will be perceptible for many hours.

I have tried this as a last resource in several cases, and always found it to be effectual. Very great care should be taken to leave the door open for some time before entering the greenhouse, as the fumes hang about for some hours, and a thorough ventilation is needed before the greenhouse may be considered quite safe. A mixture of fine Cayenne pepper with the insect powder is also useful, if it be pressed into tubes, and suffered to smoulder away as has already been recommended.

After the vapour has quite vanished, the plants and the ground beneath them should be searched, in order to discover the dead or stupefied insects, all of which should be at once committed to the flames. For insects have such a marvellous fund of life within them, and have the faculty of regaining animation under such very adverse circumstances, that the gardener will do well to be on the safe side, and to slay the slain twice or thrice if needful. The colour of *Thrips adonidum* is dull, sooty black, with the tip of the abdomen of a dusky red; the wings are white, and the limbs yellow.

Our second species, *Thrips ochraceus* is one of the many insects that come to devour the ripe peaches, apricots, plums and nectarines, and dispute their possession with the rightful owner. It mostly attacks the stems, and so causes the fruit to fall; and as its numbers are very great, and it is continually discharging the liquid already mentioned, it renders the fruit quite uneatable. This species is dusky yellow in colour, and is very slenderly made.

CHAPTER XVII.

HYMENOPTERA — Their General Characteristics — The HORNED WOOD-BORING BEE—Its Form and Burrowing Habits—Method of Tunnelling—Arrangement of the Cells—Development and Escape of the Young—A Borrowed House and its Fittings—Use of the Bee—LEAF-CUTTER BEES—The WILLOW BEE—Remarkable Structure of its Nest—Mode of Cutting the Leaf—The POPPY BEE, and its Home—The SLEEPER BEE—Why so called—Its Habits—Construction of its Nest—Adaptation to Circumstances—Its Shape and Colour—HUMBLE BEES—Their Nests and general Habits—Mode of Feeding—Species and Varieties of the Humble Bee—The BASTARD HUMBLE BEE—Its Parasitic Habits and probable Uses—The HIVE BEE—Its Use in a Garden—ANTS—The different British Species—Their Work in a Garden—Best Method of destroying their Nests.

ANOTHER order of insects now claims our attention. The HYMENOPTERA, or membrane-winged insects, include the bees, wasps, ichneumons, saw-flies, ants and gall-flies, and comprise a vast number of species. They exercise very important influences upon our gardens, some, as the hive bee and the ichneumons, being invaluable friends, while others, such as the saw-flies, and the sirex, rank themselves among our most inveterate enemies.

Taking these insects in the order which is observed in the collection at the British Museum, we commence with the HORNED WOOD-BORING BEE (*Osmia bicornis*), a wonderful little insect that derives its name from the curved horns with which the forehead of the female is armed. This pretty little bee is here given on account of its extraordinary habits, and the influence which it may exert on a garden by its wood-boring propensities.

This bee is a wonderful borer, seeming to care little about the substance in which it burrows, so that it be tolerably soft and dry. In waste countries she haunts the sea-side cliffs or sandy banks, always choosing the side that has a southern aspect. Clay and wet soils are its detestation, and when its lot is thrown among them, it has recourse to other substances—the trunks of old trees, such as the willow and the sycamore, posts, rails, and any wooden object that has been in the ground for some time and has a tendency towards decay. Sometimes, it varies its method in a very strange manner, taking advantage of the shells of dead snails, and depositing its eggs therein.

When this bee chooses a tree-stump or a wooden post for its nursery, it proceeds as follows. She—for it is the female only that burrows—begins her tunnel upwards, so that the dust and splinters of wood which she gnaws away are readily thrown out of the hole. Driving her tunnel towards the outside of the post or trunk, she now proceeds downwards, and when she has completed her burrow, she sets to work out the preparations for her young. She forms a cell near the bottom of the tunnel, deposits an egg therein, places some pollen in the cell and then closes it. Another cell is then made above the former, and so by degrees the whole tube is filled. So, in fact, the cells are disposed like a suite of rooms, the doors of which are closed, all having a solitary tenant.

But, the reader may ask, how are they to make their escape; for those eggs at the bottom of the tunnel, being the first laid, will be the first hatched and developed, and how can they make their way through all the other cells without disturbing the inmates? In order to obviate this difficulty it was conjectured that the young bees work their way out through the sides of the tunnel. This conjecture, however, is found to be quite erroneous. It is manifestly impossible, for example, that when the bee makes her cells inside a snail-shell, the newly hatched bee could force its way through so hard a material, and it is equally clear that if it were to push itself through the cells that bar its progress to the light, it would kill every other inmate of the same shell.

How, then, is this problem to be solved? The solution is as follows. The sequence in which the eggs of this bee are laid is such that the first eggs which are laid produce females, and the last produce males. Now, the female insect requires ten or twelve days more for her development than is needed by the male, and the consequence is that the males, which occupy the cells nearest the orifice, are hatched and developed and then pass into the world, leaving the passage clear for the females which are to make their appearance a few days later.

This curious fact was, I believe, discovered by Mr. F. Smith, of the British Museum, to whom my thanks are due for much curious and valuable information connected with this subject.

The plan of proceeding which has just been mentioned, is perfectly effectual when the bee bores into sandy ground or decaying wood; but when she takes possession of an empty snail shell, it is evident that her whole course of proceeding must be altered, in order to suit the cells to the variable dimensions of the shell. The tunnel dug in the ground or in wood is tolerably uniform throughout, but the shell of the snail becomes rapidly larger from the apex to the mouth. The wonderful little creature is not troubled even by this difficulty.

When she has suited herself with a shell, say of the common garden snail (*Helix aspersa*), down she goes until she has reached the farthest point which she calculates will accommodate one of her cells, and having made a cell on the oval principle, she recedes towards the opening and makes another cell. But when she recedes still farther, she finds the space too wide for her, so she makes *two* cells instead of one, and sets them side by side. When, however, she has nearly reached the mouth of the cell, she finds that even the two cells will not nearly fit the increased space, and so, instead of setting the cells upright, she lays them crosswise, and thus fills up the space.

This wonderful little bee does no great harm to the garden; for the posts in which it burrows are already falling to decay, and their downfall is very slightly, if at all, hastened by its burrows. But it certainly is a useful insect, because in its search after pollen with which to store the cells of its young, it necessarily conveys that fertilizing dust from flower to flower, and so performs an apparently trifling, but really important, task in the economy of nature.

The body of this bee is blackish and hairy on the head and thorax, and tawny on the abdomen. The male is known by the absence of horns, and by the colour of the forehead, which is whitish. A fine specimen will measure about half an inch in length.

We now come to those singular insects which, not content with merely boring a tunnel, must needs line it with hangings cut from various plants, and beautifully fitted to the house which they are intended to adorn, as well as to form a store of food for the young. These insects prefer different leaves for their habitations; some choosing the laburnum, some the rose, some the geranium, and some the poppy, the two former appearing to be the principal favourites. Our present example is the Willow Bee (*Megachile willoughbiana*).

Most of my readers must have observed the leaves of the rose and other plants scooped and scolloped in a very curious manner, the curve being struck as truly as if with a pair of compasses. These gaps in the leaf are caused by bees belonging to this group, which cut them out in order to place the pieces within their tunnels. The nest of one of these bees is a very pretty and remarkable object, looking just like a series of ladies' thimbles pressed one into the other, so as to form a tube of some length.

In each cell, or thimble (to continue the metaphor), the bee places an egg, together with a quantity of "bee-bread"—*i.e.* a mixture of pollen and honey—and then closes the aperture with some circular pieces of leaf, cut with marvellous precision and exactly fitting the orifice, and preventing the contents from escaping. The base of the next cell is pushed into the mouth of that which has just been formed; and so the insect proceeds until the nest is completed.

The manner in which the bee cuts the leaf is very curious, and is easily watched, the insect being so busily engaged upon its work, that it will permit the observer even to examine it through a magnifying-glass, without displaying any signs of alarm. Clinging to the edge of the leaf, the bee uses a pair of its legs as the feet of a pair of compasses, and its head as the point; and by turning continually upon that pair of legs, and biting the leaf as it turns, it soon cuts out a piece more or less semicircular. Just before she makes the few last cuts, which would detach altogether the portion of leaf to which she clings, the bee seeks no more support from her legs, but balances herself in the air with her wings. In a moment she makes the last bite, severing the portion of leaf entirely, and flies away with it in her claws. She always holds it edgewise, her feet being at opposite sides of the leaf. She is marvellously quick about the work, and flies off in quite a brisk and excited state with her booty.

The colour of this bee is brownish, an effect produced by tawny down upon a black body. The abdomen is rather short. The length of the insect rather exceeds half an inch.

Another species, *Megachile centuncularis*, sometimes burrows in the ground as well as in wood; but the preceding insect is never known to bore its tunnel in the ground. Mr. Smith remarks that the present species is, perhaps, the most widely distributed bee in the whole family of Apidæ. It is not only found in all parts of the United Kingdom, but is spread over all the continent of Europe, even to the north of Lapland; it is also found in Canada, and at Hudson's Bay. There is another species, the POPPY BEE (*Megachile papaveris*), not, I believe, a native of England, which employs the scarlet petals of the common poppy for the food of her young, and decorates the bare sides of the tunnel with these beautiful hangings.

ANOTHER wood-boring bee is the elegant little insect named the SLEEPER BEE (*Chelostoma florisomne*).

This pretty little bee burrows in posts and wooden rails, and perforates them in all directions, placing its eggs in the tunnels, and supplying a store of food for the future young..

This insect is notable for its custom of sleeping in the corolla of various flowers; and in this soft and perfumed bed the insect may be often found reposing, the head thrust as far as possible into the interior of the flower. The specific name of *florisomne*, or flower-sleeper, is given to the insect in allusion to this habit. Sometimes it may be seen sleeping in a very curious manner. Grasping some object with its powerful jaws, it closes them firmly, and then hangs suspended by their hooked points. After the jaws have once been fixed, no exertion on the part of the insect is required to uphold the body, and the bee sleeps securely, like the sloth hanging from his bough.

Though possessed of powerful jaws, and capable of boring a tunnel in wood without much difficulty, this bee, like others of its tribe, is not above taking advantage of a burrow that has already been constructed, or of a tube that may answer the same purpose. Many specimens of the nests have been found within the larger straws of a thatched barn.

The shape of this pretty bee is slender and elegant; the head is very square, especially at the hinder angles; and the strong jaws are bold and prominent, a peculiarity which has earned the generic name of *Chelostoma*, or Claw-mouthed. The abdomen is long and slender, small at its base and increasing in size towards the tip, which is suddenly blunt, as if cut off or pressed upwards. The colour of this insect is blackish, with the segments of the abdomen edged with yellow or whitish down. It is extremely variable in dimensions, some species being only the fourth of an inch in length, and others reaching nearly double that size.

Every one knows the Humble Bees by one of the many names by which these insects are distinguished. In some parts of England they are called Dumbledores, while in others they are termed Bummel-bees, or Foggies. With the exception of the last-mentioned title, all these names are evidently derived from the humming sounds produced during the flight, and have no connexion with the humility of the creature.

There are many species of Humble Bees, and many varieties of each species, so that even the ladybirds themselves scarcely present such difficulties to the systematic naturalist. Indeed, in many cases, the variation is so exceedingly diverse that the only method of ascertaining the species is by dissecting the insects and examining their internal anatomy.

The common Humble Bee is very plentiful in our gardens, and is a decidedly useful ally, giving its powerful aid in fertilizing the blossoms of our fruit-trees and flowers, by conveying the pollen from one plant to another. Although it is a large insect, and can carry away a considerable supply of honey, it has a very short proboscis, which is quite unable to penetrate to the bottom of the long corollas of the various flowers to which it is most partial. The insect, therefore, whenever it comes to one of those flowers, does not attempt to extract the sweet juices in the usual manner, but clings to the outside of the flower, and with its sharp jaws bites a hole through the petal, and is thereby enabled to procure the honey without difficulty.

In consequence of this propensity, the Humble Bee is thought by many gardeners to be injurious to their flowers, and is persecuted accordingly. It does, however, no harm to the flower, and ought by all means to be spared. The flower is not at all disfigured by the bite of the Bee, and even if a few blossoms were injured, the trifling damage is more than compensated by the services which it renders in fertilizing many flowers which would be sterile without its aid.

The reader is doubtless aware that among these insects there are three distinct orders, namely, males, or drones, females, or queens, and workers, or neuters. These last insects are now known to be the undeveloped females, and in certain instances they can be developed into fertile queens by being supplied with proper food and placed in suitable conditions.

The Humble Bees, like many of the Hymenoptera, are social in their habits, a number of their cells being placed together so as to form one community. They are made in the following manner.

In the winter time the greater number of the Humble Bees die, but a few of the perfect females escape that doom, and conceal themselves in various crevices, where they can remain undisturbed. Here they lie in a torpid state until the beginning of the following spring, and then awake to life and its duties. Their first object is to discover a suitable spot for their nest; and they begin on a very small scale, merely rearing a few workers, who will afterwards aid her in performing the more extensive labour required by an enlarged colony.

The grubs or larvæ are roundish, white, very fat, and slightly curved. Before they assume the pupal state they spin a large oval cocoon, of tough felt-like material, and therein remain until they have assumed their perfect form. They then begin to employ their sharp jaws in freeing themselves from their prisons, and gnaw off the tops of the cocoons so as to permit them to escape. They do not leave the nest for some days, their beautiful thick coat of hair being all wet and clogged together, and quite pale in colour. When the nest is quite complete it contains from 200 to 300 cells. Mr. Smith mentions that a nest of the common Humble Bee, which was opened in August, contained 160 workers, 35 females, and 20 males; and that another contained 107 males, 56 females, and 180 workers. The greater number of males and females had already left the nest.

The Humble Bee makes its residence under ground, taking the deserted burrow of a mouse, a mole, or some other fossorial animal, and therein forming its colony. In the spring the queen bees may be seen anxiously searching for a suitable locality for their nests; and those who desire to procure specimens in the best state for dissection, will find that such bees are in fine condition for that process.

As a general fact, there is little danger in taking the nest of these bees. I have opened very many of them, using no defence either for hands or face, and never suffered from a sting. The moss-builders are certainly the quietest. They seem to be quite bewildered when the nest is opened, and crawl about in a purposeless and listless manner.

There are, however, some species whose nests are nearly as well defended as those of the wasp or hornet, and these cannot even be approached without caution. The fiercest of the Humble Bees is, I believe, the STONE HUMBLE BEE (*Bombus lapidarius*), known by the black hairy body with the bright red colour of the last three segments. This insect mostly makes its nest in heaps of stone, but sometimes prefers old banks and the spots which are shaded by the gnarled roots of large trees. The sting of this bee is very severe; for not only is the weapon itself large, sharp, and long, but it is supplied with an ample reservoir of poison, quite as potent as that of the hive bee or wasp, though yielding in malignity to that of the hornet.

In connexion with the Humble Bees a rather curious circumstance sometimes takes place. Specimens of more than one species are occasionally found in the same nest. The moss-building Humble Bees seem to be especially liable to this curious intrusion, and in the nest of the CARDER BEE (*Bombus muscorum*) Mr. Smith has often found specimens of worker WOOD BEES (*Bombus sylvarum*).

The colour of this species of Humble Bee is black, with a yellow band round the middle of the abdomen, and a patch of the same colour at the end of the tail. The worker is smaller than the female, and in the male the yellow bands are tinged with red.

WHILE treating of the Humble Bees, it is necessary to offer a few remarks upon an insect which much resembles it in shape and general appearance, is closely allied to it in the systems of zoologists, and is a parasite upon it, residing in its nests as if it lawfully belonged to the community. This is the BASTARD HUMBLE BEE (*Apathus vestalis*), an insect for which no popular name is yet in vogue, because it has been confounded with the large tribe of humble bees.

These insects, of which few species are known to inhabit England, are wonderfully like the real humble bees, but have no neuters, and do not dwell in communities. They may be distinguished from the real humble bees by the formation of the legs, which are devoid of the little baskets or *corbicula*, which are used for the conveyance of pollen to the young.

Mr. F. Smith makes the following useful remarks on these curious parasites:—"What office these bees perform in the economy of the nest has not been discovered. They live on the most friendly terms with the industrious part of the community, and it is probable that upon them devolves some important office, the nature of which it would be very interesting to discover.

"It has been supposed, from the very close resemblance of the Apathi to the Bombi, that the former are an idle race reared at the expense of the industrious bees, and wearing a livery, in imitation of them, for the purpose of deception; but there can be little doubt of these aristocrats of the community performing important and necessary duties highly conducive to the general prosperity of the whole. That the close resemblance of these bees is not for the purpose of deception, is at once proved by the fact of *Apathus barbutellus*, a yellow-banded bee, being found in the nest of *Bombus Derhamellus*, a black species, having the tip of the body red; and we have already seen that amongst the solitary bees, the greatest difference in appearance exists."

The colour of this curious bee is black, with the front of the thorax tawny yellow, and a white band round the extremity of the abdomen.

In a work of this nature, there is no reason for occupying our space with the history of so well known an insect as the Hive Bee. Indeed, I should not have made mention of it, had not I known instances where gardeners, or rather florists, have entertained a rooted dislike to this useful insect, and destroyed it whenever they could do so. Being often men of one idea, they look upon the whole universe as subservient to their particular pursuit. To their minds the sun was made but to shine on their flowers and draw out their beauties; the winds were created but to supply them with fresh air, and the rains fall and the dewdrops glitter for no reason but to supply and strengthen their special pets.

Now there is nothing that offends a florist so deeply as any stain on the purity of his flowers; and as he fancies that the bees may give rise to hybrids by conveying the pollen of one variety to the nectary of another, he kills every bee that he finds in his garden, hoping thereby to preserve the purity of his particular "lines," as I believe the varieties are called. Futile attempts! If the bees really did mix the breed of flowers, a whole army of labourers would be required for the sole purpose of catching and killing them, and their task must begin with the earliest sunbeams, and never rest until the evening; indeed, the labour involved would be analogous to the celebrated feat of counting the bees into their hives at night.

PASSING onwards to the next family of insects, we come to the ANTS, those curious hymenoptera, which are without wings for the greater part of their lives, and even when they do assume those organs, are forced by their instinct to throw them off after they have performed their brief duties.

Many species of ant inhabit this country, most of which belong to the miners, but some take up their habitations in heaps of dried leaves and twigs. In England, the Ants are small and comparatively insignificant insects, but in tropical countries they attain very large dimensions, and both in the old and new world, certain species march in large bodies across the country, devouring all the vermin that they meet in their progress. Their bite, too, is most formidable, and when they attack a man in any number, the venom of their united forces drives him nearly frantic at the time, and seriously affects his health afterwards.

They form one of the many nuisances which render the tropical countries so unpleasant to a novice, who finds the reality rather different from the pictured semblance. They are most useful beings, playing no inconsiderable part in the great work of nature, which, under the tropics, is carried on with such rapidity and on so large a scale. Under the burning influence of the vertical sun, life and death follow each other with wonderful rapidity, and scarcely has an animal or a plant died before its remains are seized upon by countless beings and converted into fresh and living forms.

The Ants are among the most energetic of these transmuters. Brisk, active, voracious, armed with powerful jaws and a store of poison, these wingless hymenoptera pervade the country, and swarm in every nook. Every tree is covered by their ascending and descending hosts; and though it appears to us in England an easy task to climb a tree, the traveller in tropical countries takes a very different view of the subject, and when he sees any remarkable object in the branches of a tree, or perchance has shot a rare bird, which is still hanging in the boughs, he would rather lose the valued object than expose himself to the attacks of the Ants which swarm on every branch.

In this land, however, the Ants are so small that their presence can inflict no injury, and at the worst, only amounts to annoyance. Many gardeners fancy that the Ants are injurious to them, and therefore destroy the insects whenever they find opportunities for so doing. I cannot, however, agree with them on this point, but think that whatever influence they may exert is rather beneficial than otherwise, their diet being of an animal nature, and not leading them to commit depredations on the flowers or fruit. They certainly destroy many noxious insects, and I have seen them carrying grubs to their nests, holding them in a very curious fashion.

As the Ants are obliged to thread their way among many obstacles—which, although they appear insignificant to us, are very formidable to those tiny insects—were they to hold the grub by the middle, they could not pass it through a narrow defile; they therefore hold it by one end, and are thus enabled to steer it safely between grass blades, fallen twigs, dead leaves, and the various substances that lie on the ground, and obstruct the progress of the insect.

If the gardener wishes to keep the Ants from any standard flower or tree, such as a lily or a rose, he can do so by winding a piece of wool round the stem, the insects not liking to traverse that substance; but as they really do no harm to the flower, and, like the bees, are really beneficial in conveying the fructifying pollen to the spot where it is needed, they should rather be protected than destroyed. Sometimes, however, their nests are so very plentiful in a garden, that they require to be thinned, and that process is accomplished without difficulty in several ways.

Digging up the nest, and filling the spot with gas-lime, is one plan that is recommended, as is also pouring a strong decoction of elder leaves into the nest, taking care to do so at night. I have found, however, that when the nests are so numerous that they really must be destroyed, the simplest method is to pour some gunpowder into them and set fire to it.

The effect is instantaneous; there is a flash, a puff, and all is over, every insect being killed in a moment, and the nest totally destroyed.

There is no explosion, because the opening of the nest allows the force of the powder to expand itself through the outlet instead of blowing up the earth and scattering it about. Very little powder is required, and the only precautions to be observed are, to choose a dry evening, so that the powder may not be wetted, and to fire the train by means of a piece of touch-paper fastened to the end of a stick at least three feet long; touch-paper is made by soaking paper in a solution of nitre, or even by rubbing it with wetted gunpowder. In this way the garden may be cleared of ants' nests in a very short space of time.

The larger species of British Ant, such as the Wood Ant, are very seldom seen in gardens, because they cannot in such localities obtain a proper amount of the substances with which they build their nests. The Black, and Brown, and Yellow Ants, are those which are most frequently found in our gardens, and of these the first-mentioned species is the one that is most hated, because it makes its nest in posts and tree-stumps, destroying the wood rapidly in its excavations. Still, even this creature does no real harm. It cannot burrow into a post so long as the wood is sound, and therefore the gardener ought rather to be grateful to it for pointing out to him the posts that require to be renewed, and are no longer fit for use.

There is one species of ant, which, although it does not reside in the garden, has of late years taken possession of buildings. This is the Domestic Ant, a very minute yellow species. This species is thought to have been imported from North and Central America, and has spread wonderfully through the kingdom. It has been known to swarm in houses to such an extent that the inhabitants were forced to leave the premises until the wooden floors had been replaced by tiles and cement. During the last year of my residence in a set of chambers in the City, the Domestic Ant made its appearance, and was very disagreeable, running over every article of furniture, haunting the book-shelves, and intruding in every place where its presence was least to be desired.

Closely connected with the preceding insects is another group, called the Solitary Ants, because they do not assemble in societies, as is the case with the insects which have just been described. There are only two sexes, the male and the female, the neuters being wanting. Of the two sexes, the former possesses wings, but the latter is without them, and is altogether so ant-like in shape, that she is often mistaken for one of those insects.

In this country there are only two accredited and one doubtful species, and neither of them attain large dimensions; but in the hotter parts of the world they are very plentiful, are of large size, and are well known for the severity of their sting. One species, the Scarlet Mutilla of North America, has a sting nearly as long as the abdomen, and is furnished with such virulent poison, that its sting is little inferior in evil effects to the bite of a venomous snake. A child has been known to die from the effects of a sting inflicted by one of these insects, and even a man has suffered so severely that his life has been despaired of for some time.

The European Solitary Ant (*Mutilla Europœa*) seems to be rather a local insect, but is tolerably plentiful in the spots where it takes up its residence. It is parasitic upon the common humble-bee, feeding apparently upon the larva of that insect.

Mr. Drewson has given a detailed account of the habits of this insect, and has discovered some rather curious particulars. It sometimes takes such wholesale possession of the nests of the humble-bee, that in a single nest, wherein the rightful inhabitants were confined to two workers, no less than seventy-six specimens of the Solitary Ant were found, the greater number being males. The grubs were found within the cells, which were closed by their silken covers, as is done by the full-grown bee larva; and yet, when the full-grown larva of the Solitary Ant was found, that of the bee had vanished, having apparently been devoured by the parasite. There are other insects on which the Solitary Ant is parasitic, because in countries where the humble-bee does not exist, or is very scarce, the Mutillidæ are peculiarly plentiful.

The female of this species looks like a very large ant, being half an inch or more in length. The colour of the head is black, that of the thorax is reddish, and upon the black abdomen are several bands of lustrous pale yellow hair. The male is smaller and of a steely lustre, and the wings are pale brown deepening towards their tips.

CHAPTER XVIII.

SAND-WASPS—Their general Appearance, Habits and Services—William Howitt's account of a Sand-Wasp—The MELLINUS—Its Curious Habits—Fly Hunting—Death and Burial—The Food and Development of the Young—The TRYPOXYLON—Localities chosen for its Tunnels—Spider Hunting—Ingenious Capture—Arrangements of the Cells, and Food of the Young Bee—The WASP—Its ravages in a Garden—Prevention better than Cure—How to take Wasp Nests—Use of Wasp Grubs—The HORNET and its Habits—Use of the Hornet—Wasp Hunting—Fierceness of Disposition—The CRABRONIDÆ—Scientific Names—Habits of the Insects; their Mode of Catching their Prey; their Nests and their Uses—Hidden Wisdom—Bee Hunting and Hive Robbing—A valuable Insect—A strange Mistake—The CUCKOO-FLIES—Their Brilliant Hues—Habits of the Cuckoo-Flies—Reason for their Name—Ingenuity and Perseverance—Use of the Cuckoo-Flies.

THE next insect which we have to notice is a really valuable one to the gardener and agriculturist, and ought to be better known than it is. The common SAND-WASP (*Ammophila sabulosa*) may be known by the peculiarity of its shape and by its colouring. It is a pretty, slender, delicately-made insect, with a very long abdomen, and long, spiny legs.

This insect is most valuable in the destruction of caterpillars, not for its own food, but for that of its young. It first bores a hole in sandy ground, and makes a little chamber at the end. The next task is to search for the caterpillar of some moth, which it seizes and conveys to the burrow. It then takes the caterpillar into the chamber, lays an egg upon it, and then closes the mouth of the burrow with a few little pebbles. It then fetches another caterpillar, removes the stones, places the victim in the hole, covers it up again and starts off for another. This process is repeated three or four times, and the insect then makes another burrow and fills it in a similar manner. Thousands of noxious caterpillars are thus killed yearly by this insect, which ought to be encouraged by every one who possesses a garden.

An allied species, the HAIRY SAND-WASP (*Ammophila viatica*), acts in a similar manner, but takes spiders instead of caterpillars. Mr. W. Howitt has described the proceedings of this insect with such force and fidelity, that I need make no apology for introducing the account into these pages.

"In all my observations on the habits of living things, I have never seen anything more curious than the doings of one species of these ammophilæ—lovers of sand. I have watched them day after day and hour after hour in my garden, and also on the sandy banks on the wastes about Esher, in Surrey, and always with unabated wonder. They are about an inch long—each with orange-coloured bodies, and black heads and wings. They are slender and most active. You see them on the warmest borders of your garden, or on the warm dry banks, in summer, where the sun comes hotly. They are incessantly and most actively hunting about. They are in pursuit of a particular grey spider with a large abdomen. For these they pursue their chase with a fiery quickness and avidity. The spiders are on the watch to seize on flies; but here we have the tables turned, and these flies are on the watch to discover and kill the spiders. These singular insects seem all velocity and fire. They come flying at a most rapid rate, light down on the dry soil, and commence an active search. The spiders lie under the leaves of plants, and in little dens under the dry little clods. Into all these places the Sand-Wasp pops his head. He bustles along here and there, flirting his wings and his whole body, all life and fire. Now he moves off to a distance; hunts about there; then back to his first place; beats the whole ground carefully over, as a pointer beats a field. He searches carefully round every little knob of earth, and pops his head into every crevice. Ever and anon he crouches close amongst the little clods, as a tiger would crouch for his prey. He seems to be listening, or smelling down into the earth, as if to discover his prey by every sense which he possesses. He goes round every stalk, and descends into every crevice about them. When he finds the spider, he despatches him in a moment; and seizing him by the centre of his chest, commences dragging him off backwards.

"He conveys his prey to a place of safety. Frequently he carries it up some inches into a plant, and lodges it amongst the green leaves. Seeing him do this, I poked his spider down with a stick after he had left it; but he speedily returned, and, finding it fallen down, he immediately carried it up again to the same place.

"Having thus secured his spider, he selects a particular spot of earth, the most sunny and warm, and begins to dig a pit. He works with all his might, digging up the earth with his formidable mandibles, and throwing it out with his feet, as a dog throws out the earth when scratching after a rabbit. Every few seconds he ascends, tail first, out of his hole, clears away the earth about its mouth with his legs, and spreads it to a distance on the surface. When he has dug the hole, perhaps two inches deep, he comes forth eagerly, goes off to his spider, drags it down from its lodgment, and brings it to the mouth of his hole. He now lets himself down the hole, tail first, and then, putting forth his head, takes the spider and turns it to the most suitable position for dragging it in.

"It must be observed that this hole is made carefully of only about the width of his body, and therefore the spider cannot be got into it except lengthwise, and then by stout pulling. Well, he turns it lengthwise, and seizing it, commences dragging it in. At first you would imagine this impossible, but the Sand Wasp is strong, and the body of the spider is pliable. You soon see it disappear. Down into the cylindrical hole it goes, and anon you perceive the Sand Wasp pushing up its black head beside it, and having made his way out, he again sets to work, and pushes the spider with all his force to the bottom of the den.

"And what is all this for? Is the spider laid up in his larder for himself? No, it is food for his children. It is their birthplace, and their supply of provision while they are in the larva state.

" We have all along been calling this creature he, for it has a most masculine look; but it is in reality a she: it is the female Sand-Wasp, and all this preparation is for the purpose of laying her eggs. For this she has sought and killed the spider, and buried it here. She has done it all wittingly. She has chosen one particular spider, and that only, for that is the one peculiarly adapted to nourish her young.

" So here it is safely stowed away in her den; and she now descends, tail first, and piercing the pulpy abdomen of the spider, she deposits in it an egg, or eggs. That being done, she immediately begins filling in the hole with earth. She rakes it up with her legs and mandibles, and fills in the hole; every now and then turning round, and going backwards into the hole to stamp down the earth with her feet, and to ram it down with her body as a rammer. When the hole is filled, it is curious to observe with what care she levels the surface, and removes the surrounding lumps of earth; laying some just over the tomb of the spider, and others about, so as to make that place look as much as possible like the surface all round. And before she has done with it—and she works often for ten minutes or more at this levelling and disguising before she is perfectly satisfied—she makes the place so exactly like all the rest of the surface, that it will require good eyes and close observation to recognise it.

" She has now done her part, and nature must do the rest. She has deposited her eggs in the body of the spider, and laid that body in the earth in the most sunny spot she can find. She has laid it so near the surface that the sun will act on it powerfully, yet deep enough to conceal it from view. She has, with great art and anxiety, destroyed all traces of the hole, and the effect will soon commence. The heat of the sun will hatch the egg. The larva, or young grub of the Sand-Wasp, will become alive, and begin to feed on the pulpy body of the spider in which it is enveloped. This food will suffice it till it is ready to assume the chrysalis, and will continue there, probably, till the period when the influence of nature will call it out in the shape of its parent fly, to renew the same cares, and exhibit the same most wonderful instincts. Like the ostrich, the Sand-Wasp thus leaves her egg in the sand till the sun hatches it; and having once buried it, most probably never knows herself any longer where it is deposited. It is left to nature and Providence."

Mr. F. Smith tells me that there are one or two trifling and really unimportant errors in this vivid and accurate description, which may as well be set right. The Sand-Wasp does not pierce the abdomen of the spider for the purpose of depositing the egg, but attaches a single egg to the body of the spider by means of a gummy secretion. The wings, too, can scarcely be considered black, their dark colouring being but slight. It is worthy of notice, that while engaged in the laborious though pleasing task which has just been described, the insect keeps up a loud, shrill piping sound, very peculiar, and of itself calculated to attract the attention of careful observers of nature.

This species feeds almost, if not exclusively, on spiders; while the preceding species attacks nothing but caterpillars.

Another of these burrowing hymenoptera now comes before us, known to entomologists by the name of *Mellinus arvensis.* I believe that no popular title has been given to it.

This is a common and very interesting insect, and may, like the sand-wasp, be reckoned among the friends of the gardener. Following out the system adopted by the insect just mentioned, the Mellinus makes a hole in the ground, and forms a chamber at its extremity. It then sets off in search of prey, and always brings back a fly of some kind. Diptera of various genera and families fall victims to the Mellinus, which contrives to catch even the swift-winged hoverer flies, though itself a slow and rather laborious flier. Being unable to take its prey by fair chase, it has recourse to stratagem, and proceeds as follows.

Selecting some spot where flies are likely to settle, it waits about the place, and when it sees a fly alight, it pretends to take no notice, but continues to run about in an apparently unconcerned manner, passing and repassing the unsuspecting fly, but always approaching nearer at every turn. Suddenly it wheels quickly, dashes at the fly with unerring aim, and carries it off to the burrow.

The helpless fly is quickly thrust to the bottom of the tunnel, an egg is laid upon it, and the indefatigable labourer goes off for another victim. The rapidity of this operation is considerable in fine weather, when flies are plentiful and the ground dry. But in wet weather, the labours are often suspended for several consecutive days. By a series of experiments, it was found that each larva requires about six flies, and that it eats them in orderly succession, rejecting the head, limbs, and the greater part of the thorax. When it is full grown, it spins a cocoon of a tough fabric, and there lies until it has assumed its perfect form, when it emerges into the world, and in its turn seeks for flies as food for its future offspring. These insects make their appearance about the end of summer, or the beginning of autumn.

The colour of the insect is black, adorned with several bands and spots of yellow. These marks are extremely variable, both in size and shape. The male is much smaller than the female.

One more species of these predatory hymenoptera remains yet to be noticed. It is known to entomologists as *Trypoxylon figulus*, and, though it is very plentiful, seems to have received no popular name. The shape of the insect can be recognised from the illustration; the colour is black, with a fine silken down edging the segments of the abdomen, and having a silvery kind of lustre.

This species makes its burrows in banks, where the earth is light, preferring those of a sandy nature. Sometimes, however, it makes its nurseries in decayed wood, and separates the cells from each other by a layer of sand, glued together by some adhesive secretion. Spiders are chosen by this insect as the food for its young, and with those creatures it provisions its cells, as has already been narrated of the sand-wasps. It generally contrives to choose a locality where spiders are abundant. In catching its prey it is very ingenious, and has often been observed to snatch a spider out of its web, without running the least risk of capture.

This insect will take advantage of the holes formed by other creatures, and, instead of doing the whole of the work, contents itself with enlarging the ready-made holes. A coating of fine sand is applied to the burrow, and the habitation is then ready for the store of spiders. The number of spiders placed in a cell is extremely variable, according to their dimensions, three or four small specimens being considered equivalent to a single large one. Spiders of the genus Epeira seem to be the greatest favourites. The cells which this insect makes are separated from each other by a double partition of clay; and in each cell there is but a single egg, though ten or twelve spiders may be stored within its walls.

Several species of this genus are found in England, all of which are in the habit of burrowing into decaying wood, and therein founding their little colonies. One species, *Trypoxylon alternatum*, is in the habit of burrowing into the pith of dried rose-branches. Its nests look very pretty, and are easily found; for if the end of a broken rose-branch, whether it be the wild or cultivated variety, be examined, and a little round hole be discovered in the pith, some cells of this insect are sure to be in the branch. The generic name of these insects is composed of two Greek words, and signifies wood-borer.

THE next insect on our list is the COMMON WASP, so well known for its combativeness, its voracity, its beautiful nest, and the virulence of its sting.

Though very carnivorous in its habits, and a mighty hunter of flies, the Wasp is also a lover of fruit, and is apt to make great havoc in the orchard. It will touch none but the ripest fruits, and is as good a judge of their merits as the gardener who reared them. Apricots, plums, peaches, and other stone fruits are its delight, and it will often penetrate into the very middle of the fruit, and remain there even when it is removed from the tree. Any one who has been accustomed to eat fruit as it comes off the tree must have been occasionally startled, when about to eat an apricot or a plum, by the black and yellow head of a Wasp making its appearance out of the very spot which he was just going to put into his mouth.

Wasps are very variable in their numbers; in some years being scarcely ever seen, while in others the swarms of Wasps quite overrun the gardens. Prevention is proverbially better than cure; and by care the summer broods of Wasps can be effectually checked. As is the case with the humble-bee, the Wasp community consists of males, females, and neuters. During the winter, all the neuters and males, and most of the females, perish; but a few remain hidden away until the spring, when they issue from their retreats, ready to commence new colonies. Every Wasp, therefore, which is seen in the spring is the foundress of a future colony.

All Wasps seen in the early part of the year should be destroyed, and rewards given to children for every specimen which they can capture and bring as evidence of their success, for every Wasp thus killed in the spring is equivalent to a whole colony destroyed in the summer; and, as a colony consists of more than two thousand individuals, it is evident that less pain is inflicted, and less destruction of life involved, than if the nests themselves were broken up at a later part of the year.

No fears need be entertained lest the numbers should be too much reduced. By far the greater number will escape, and the needful supply of Wasps will assuredly be kept up. If, however, in spite of all precautions, the insects should be too abundant, they must be traced to their nests, and their colonies destroyed. There is not the least hazard in the matter, and any one can destroy a Wasp's nest without running the least risk. I have taken innumerable nests, even in the daytime, and have never once been stung while engaged in the burglarious undertaking.

The Wasp, as most of my readers are aware, is generally in the habit of building its wonderful home in the ground, taking advantage of some deserted burrow, and therein forming the successive layers of paper cells in which the young grubs are bred. Sometimes the nest lies at a considerable distance below the ground, and sometimes it is comparatively near the surface; but the combs are always defended from the contact of soil by a covering of the same material as is employed in building the cells. The shape of the nest is more or less globular, and its size varies according to the number of its inmates.

Night should always be chosen for destroying the nests, because the Wasps are all at home. None, therefore, can escape, and none are flying about outside, ready to attack the intruders. It is most annoying, while engaged upon this work, to find the Wasps constantly arriving, each more angry than the preceding, and all busy with their stings. Beating them off with leafy boughs is the only possible mode of averting their attacks, and it is necessary that two or three individuals should be "told off" for this work, while the others are engaged in their destructive labours.

But if the dead of night be chosen for the time of attack, there is no such difficulty, and one person can destroy six or seven nests with perfect ease in a single evening.

The preparations are few and simple. Take a round ruler of moderate diameter, and roll paper tightly round it, tying up one end, and closing it securely with sealing-wax. Remove the ruler, and you have a tube ready for the reception of the mixture which is to cause the death of the Wasps. Take some gunpowder, put about a teaspoonful into the tube, and ram it down tightly. Now damp a moderate quantity of gunpowder, and, when it is capable of being worked like very stiff dough, push it into the tube, and ram it down. Leave about half an inch unfilled. Rub down some powder with an ivory paper-knife, upon a hard wooden board, or zinc, or copper slab, so as to crush the grains and reduce it to a greyish dust. Fill up the tube with this "mealed" powder, paste a piece of touch-paper round the mouth of the tube, twist it round so as to prevent the powder from escaping, and your weapon is completed. One of these will be required for each nest.

These "squibs" should be made in the morning, and the mealed powder should not be inserted until the evening.

A few hours after darkness has set in is the best time to take the nests, say ten or eleven P.M. Take with you a trowel, a small pail, a lighted bull's-eye lantern, a few wax matches, and some touch-paper. When you have reached the spot, cut a good piece of turf, bore a hole through the middle, and insert the squib into the hole, so that its butt just projects upon the grassy side. Mix up a quantity of moderately stiff mud in the pail, and all is ready.

Advance very cautiously towards the entrance of the nest, taking care not to tread heavily, and be specially careful of allowing the light of the lantern to shine into the entrance. Wasps are wary creatures, and your object is to trap them all while asleep. I always find that the best place is about a yard on the left side of the entrance. Light the touch-paper at the end of the squib, and hold the turf in both hands, ready to place it on the entrance.

As soon as the meal powder begins to fizz, insert the blazing squib into the hole, press the turf firmly down, take a trowel full of mud, and look out for smoke. As soon as the white fumes arise from any aperture, close it with mud, and be very careful to plaster the edges of your turf with the same useful material.

Meanwhile, the squib is making a vast hissing and roaring, and presently a loud report is heard, caused by the explosion of the spoonful of dry powder which lies at the bottom of the tube, and away flies the empty case through the air, marking its passage with a train of glittering sparks. A trowel full of mud should immediately be applied to the hole in the turf through which the tube has made its exit, and the nest may then be left until the morning.

A little practice gives great expertness in these proceedings, and the nest can be effectually smothered in less time than has been occupied in writing these directions. I have of late been accustomed to mix flour of brimstone largely with the damp powder, as the sulphurous fumes of that substance are fatal to insect life. The spoonful of dry powder at the bottom of the squib is peculiarly useful. It not only gives notice that all the powder is consumed, but, by its violent explosion, drives the fumes into the farthest recesses of the nest, and so betrays any second opening, should one exist, by forcing the white smoke into the air.

The grubs of the wasp are admirable food for poultry, and if they are well aired, that the sulphurous odour may be removed, they will be eaten greedily. They also make excellent bait for anglers, but, as they are naturally too soft to remain on the hook, they must either be baked, or plunged for a short time into boiling water.

Sometimes the nest is made among the rafters of an outhouse, or in similar situations, and in that case the outer covering is of quite a different texture to that which is employed when the insect builds in the ground. Such nests are not easily taken, and the best method with which I am acquainted is to go very quietly at night, with a long-bladed knife, and large jar, and a lantern. The nest should be rapidly removed, dropped into the jar, and the mouth covered, so that the alarmed insects cannot escape. They may then be destroyed at leisure, or if the captor be of an inquiring nature, he can use a glass jar for this purpose, and then fix it in a window, so as to permit the Wasps free exit into the open air. They will not meddle with him, and he will have the pleasure of seeing them at their daily tasks. There are about six species of British Wasps, some of which habitually build their nests underground, and others in trees.

THE well-known and formidable HORNET (*Vespa crabro*), belongs to the same genus as the wasp, but is readily distinguished from them by its greater size, and the red markings upon the head and body. A fine specimen of the female Hornet measures more than an inch in length, and even the males and workers are, upon an average, three quarters of an inch long.

This is a most powerful insect, delighting to feed on the wasp, which it seizes and destroys without paying the least regard to its sting. It will haunt the ripe fruit, not so much for the sake of the sweet juices, though it by no means disdains a short repast on a plum or a greengage, but for the express purpose of catching the wasps, which always flock to such spots. It will even chase the wasp while on the wing, and seize it in the air. Mr. Knapp observes that "the first operation was to snip off the head, then to cut away the lower part of the waist, and when near, we could hear them shearing away the outer coat from the body, and crushing it with their strong mandibles; sometimes devouring it, but generally only sucking the juices it contained.

"Their avidity for this sort of food is very manifest when the grape ripens on the wall. Being commonly the only remaining fruit, the wasp abounds there; the Hornets flock to the prey, and we may see them in constant progress, bearing their victims from the bunches. We do not know any insect that destroys the Hornet, but its power and being are terminated by some very effective agent, as in particular years it is almost unknown."

It is a fierce and determined insect, not only fighting furiously with its own kind, but resisting the attacks of man. Even when captured in a net, it fights vigorously, endeavouring to make its escape; and I have had my own net so cut to pieces by the sharp jaws of the Hornets that I have been obliged to change the gauze before the net could be used again.

To the gardener it certainly does no harm, and inasmuch as it kills the wasp, may lay claim to be ranked among his friends.

A RATHER large family of hymenoptera now comes before us, known by the name of Crabronidæ. Many of these insects have a close resemblance to the wasps and hornets, and by persons unacquainted with entomology are often thought, on account of their small size, to be the young of those insects. They are active little beings, and are very common, being fond of basking in the sunbeams, and sitting motionless on the leaves in order to enjoy the warm rays.

Our first example of this family is the interesting insect called scientifically *Oxybelus uniglumis.* I much regret that in many instances it will be found necessary to give names derived from the Greek and Latin languages; but as the insects are not known to the general public so well as they deserve, no popular names have been given to them, and so I am obliged to mention them by the titles under which they are known to entomologists.

This is a very common insect, and may be seen in the summer months reposing on the spreading blossoms of various umbelliferous flowers.

Like the sand-wasp, this insect digs a burrow in the ground, employing for this purpose the two fore-legs, scratching with them like a terrier trying to dig out a rat, and moving them with great rapidity and apparent zest. When it has completed the tunnel, it sets off in search of prey, which always consists of flies, and displays great ingenuity in their capture. It is comparatively a slow-winged insect, and is therefore obliged to capture its prey by craft.

While engaged in this process, it acts in a manner similar to that which has been already narrated of the mellinus. It proceeds to some sunny bank, where flies most congregate, and parades about among them as if quite unconcerned. They soon become accustomed to its presence; and the insect then craftily contrives to sidle up to one of the unsuspecting flies, pounces suddenly upon it, and carries it off to its burrow. Almost any kind of fly suits its purpose, and in consequence it does not take a long time in filling its cell with food for its future young. Although slow on the wing, it is quick and active on foot, and bustles about in a very spirited manner, as if it knew the value of time and were intending to make the best use of its short life.

OUR next example of these insects is the *Pemphredon lugubris.* The former of these names is a Greek word, signifying some wasp-like insect which burrows into wood, and the latter name is given to it on account of its black and funereal aspect.

It is a pretty little insect in spite of the uniform jetty blackness of its colour, being elegantly shaped, and of a peculiarly neat and well-turned outline. This insect burrows in wood, preferring that which is partially decayed, and throwing out the sawdust rapidly as it nibbles its way with its strong jaws. When it has completed its burrow, it stocks it with aphides, catching and stowing away a great number of these troublesome little insects. This creature, therefore, is a very excellent friend to the gardener, and renders most valuable service by aiding in the destruction of those little green pests, which increase so rapidly and do such damage to the flowers. The shape of this insect

can be learned from the illustration, and, as has already been remarked, its colour is jetty black.

THERE is a minute and very useful insect, called *Stigmus* (or *Spilomena*) *troglodytes.*

This insect is likewise in the habit of capturing prey, placing it in its cells, and then leaving it to form the food of its young progeny. Small as it may be, it is a really useful insect, being accustomed to seize the larvæ of the thrips and to lay them up in its cells. It does not burrow into wood or into the ground, but takes advantage of tubes ready made, and haunts thatched roofs in search of convenient straws. Into these receptacles it conveys the prey; and though it is a very small insect, it stows away a vast number of the thrips, as many as fifty victims having been found in a single cell.

The reader will perhaps have taken occasion to notice the stores of knowledge which lie hid in nooks and corners, and which would be overlooked except by those who have trained their observing faculties. Few persons would think that there is anything of interest in a handful of old thatch, and yet we find that these neglected and apparently useless straws form the home of many a tiny insect, which yet exerts a powerful influence upon the welfare of agriculture. The specific name, *troglodytes*, is of Greek origin, and signifies a creature that dives into recesses. It has been given to this insect in allusion to its habit of penetrating into the straws.

THE next insect on our list is rather larger than that which has just been mentioned, and has a much shorter name, *Psen pallipes.* The former of these titles is of Greek origin, and is scarcely appropriate to the insect, being more rightly applied to one of the numerous gall insects. The latter name is merely in allusion to the colour of the legs, which are paler than the body.

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The whole of the species belonging to this genus are useful to the gardener, as they prey upon the aphides, and destroy vast numbers of them. Some specimens burrow in sand, while others prefer to make use of straws, and therein provide nutriment for

the young. As many as a hundred aphides have been observed stored away in a straw, and the egg from which is to be hatched the grub that will devour all these creatures is attached to the body of an aphis, and placed at the bottom of the cell. In colour it is white, and semi-transparent.

It is rather a pretty little insect, slightly and delicately made, and quite black in colour.

Our penultimate example of this interesting family is the insect known by the name of *Philanthus triangulum.* It has a very waspish look about it, and is quite as mischievous in its habits.

It is one of the burrowing species, making its tunnel in sandy situations, digging them to the depth of about five inches, and seldom driving the tunnel straight, but giving it a tortuous direction. Southern banks are preferred for this purpose, probably because the warmth of the sunbeams enables the young to pass through their development sooner than would be the case were the holes made in a situation where the sun would not shine upon them. The tunnel has then to be filled with prey; and for this purpose the bold insect proceeds to the beehive, and seizes, kills, and carries off the formidable hive-bee to serve as nutriment for the coming brood.

The destruction wrought among the hives by this insect is in some countries very great; for in France no less than fifty females were found at work upon a single bank, only forty yards in length. Now, each Philanthus kills at least five or six bees, and so it may be safely calculated that, in that short space of forty yards, at least two hundred and fifty bees were entombed. These calculations are, however, very much understated, and if the figures were doubled, they would probably not exceed the reality.

When the young larva has eaten its way through the food so liberally provided, it prepares for its last change, and forms a cocoon of large size, considering the insect which makes it. It is flask-shaped, very thin and delicate in structure, except towards the base, where it becomes thicker and darker.

The manner in which this insect seizes the powerful and formidable hive-bee is highly characteristic. Though not so strong an insect, it is much more agile, its celerity more than compensating for its lack of muscular strength. The bee has no chance against its active foe, which sweeps down upon it like a falcon on a partridge, stings it to death almost simultaneously with its attack, and flies off to its nest with the inert body in its grasp. July is, perhaps, the best month to watch the habits of the Philanthus. Several other bees, especially those belonging to the genus Andrena, fall victims to this energetic marauder.

The specific name of this insect has been given to it on account of the dark triangular marks along the abdomen. The generic term, *Philanthus*, is of Greek origin, signifying a lover of flowers, and is given to the insect because it is fond of resting upon flowers and basking in the sun.

These examples are selected from a large number of species, as being good types of the family; but there are many other species which are quite as interesting. For example, several species of the genus Crabro are powerful miners and predacious hunters, boring their way deeply into posts and decaying trees, and provisioning their young with small caterpillars, flies, and other insects. Bluebottle-flies seem to fall victims to these insects in great numbers, the rejected portions nearly filling the cell in which they had been consumed.

We now proceed to the members of this genus which are last on our list. There is a pretty little hymenopterous insect called *Mimesa bicolor*, with a large head, rather long legs, and a delicately-made abdomen, which is of very great service to the gardener, inasmuch as it selects for its prey that curious larva called the cuckoo-spit, in consequence of the large amount of froth which issues from its body, and in which it remains concealed.

An allied species was seen by Mr. Westwood to be very busily engaged in pulling a cuckoo-spit insect out of the mass of froth in which it was enveloped. This feat she failed in performing, though she tried to pull the insect out with her legs, and to pierce it with her sting. Being baffled in her endeavours, she turned her attention to another point, and committed a curious error. By some mistake, she attacked a drop of water, thinking it to be the liquid that distils from the cuckoo-spit, and for some time endeavoured to seize the imaginary occupant. A third time did the persevering insect attack a bunch of froth, and a third time was she unsuccessful.

Perseverance, however, met with its reward, for she at last succeeded in capturing one of the desired insects, and went off in triumph, holding it beneath her body, by clasping her middle pair of legs round it.

THE reader will doubtlessly have noticed in the garden certain small bee-like insects, which flit about the walls, banks, or leaves of trees, and are notable for the gem-like brilliancy of their colouring.

Their bodies are clad in highly-burnished mail, which glitters with the brightest hues of the ruby, emerald, and sapphire, and they have therefore been appropriately called the humming-birds of the insect tribes. These are the CUCKOO-FLIES, so called on account of their parasitical habits; for though many insects are in the habit of depositing their eggs in the habitations prepared for others, their colours are not so brilliant, and, therefore, they do not attract so much attention as the glittering insect upon which we are now engaged.

The most common species is the FIRE-TAILED CUCKOO-FLY, a very lovely insect, with the abdomen glowing in the sunbeams, as if lighted by internal flames.

All these insects are remarkable for the structure of the abdomen. At its extremity, it is furnished with a long telescopic tube, which is capable of being extended until it is nearly or quite as long as the abdomen, and in the female insect it has a small and sharp sting at its extremity. This sting is not supplied with poison, and therefore, although it can inflict a rather startling wound, as I have often experienced, the pain is very transient, and no swelling supervenes.

The Cuckoo-flies follow the example of the bird from which they derive their name, and deposit their eggs in the nests of other Hymenoptera. They are most vigilant when engaged in this task, traversing walls, trees, and banks, in search of nests, and seldom allowing a single domicile to escape them.

When they have discovered a suitable spot, nothing will deter them from entering and fulfilling their mission. They boldly enter the nests of the fiercest and most venomous insects, and care nothing for their stings. Whenever possible, they endeavour to choose a time when the rightful owner is absent, though they sometimes make a mistake, and either find themselves suddenly in the presence of the lawful inhabitant, or are surprised before they can leave the spot.

Under these circumstances, there is only one mode of action. The Cuckoo-fly is quite unable to cope with the wasp, or with many of the sting-bearing bees, in whose nests it places its eggs. As soon, therefore, as it sees the enemy advancing to the attack, it coils itself up like a hedgehog, and lies in passive endurance. In vain does the angry foe attempt to kill the glittering creature that lies apparently helpless under its feet. No sting can make its way through such polished armour, and the Cuckoo-fly remains in perfect safety.

One of these insects gave a curious proof of the efficacy of this defence, and also of the singular perseverance with which it carries out its labours. It had entered the nest of one of the large mason-bees, and was just about to deposit its egg, when the bee came home laden with pollen, and immediately flung itself upon the intruder. The Cuckoo-fly coiled itself up, and thus baffled all the endeavours of the enemy. At last, the angry bee ceased its attempts at stinging, and taking hold of the wings at their junction with the body, bit them off, and then dropped the dilapidated body on the ground.

She then went off to renew her search for pollen, but she had scarcely left the spot, when the mutilated Cuckoo-fly gathered itself together, tried its limbs, crawled up the wall to the entrance of the nest, and so, though devoid of wings, it succeeded in the great object of its life. It is worthy of remark, that the egg was placed against the side of the nest, and behind a mass of "bee-bread," *i. e.* pollen-paste, so that the bee might not be able to see it when she returned. The Cuckoo-fly could not understand the reason for its action, but the mere fact of such a proceeding fills us with wonder, that the little things of this world should be so carefully developed, and their welfare so carefully considered. "Maximus in minimis cernitur esse Deus."

Wherever the Cuckoo-fly has succeeded in placing its eggs, the fate of the lawful inmate of the cell is sealed. In some cases, the grub feeds upon the various insects that have been laid up in store, and so the legitimate sovereign of the cell is starved to death. Sometimes, however, the egg is not hatched until the grub has nearly attained its full dimensions, and in such cases the newly-hatched grub seizes on the shoulders of the original tenant, and soon destroys it.

These insects do not appear to form a cocoon, but they remain for a long period in the pupal state. The Cuckoo-flies are parasitic upon many insects which we have already described. Some species persecute the Psen sadly, and among a row of cells made by that insect, two or three cells of the Cuckoo-fly have been observed, arranged in precisely the same order as the cells which they simulated.

It is said that the mason-bees are quite aware of the character of these insects, and that whenever they see a Cuckoo-fly near a nest, they unite their forces and drive it away. But I very much doubt whether this account is worthy of credit. The bees on which the insect is parasitic are solitary in their habits, and though several of them might happen to be congregated upon some favourable locality, and to have attacked the despoiler of their nests, each insect would act independently of the other, and would have attacked the Cuckoo-fly quite as fiercely if no companions had been at hand.

There is no doubt respecting the mutual abhorrence of the bee and the Cuckoo-fly. Each has its instinct, the one endeavouring to evade, the other to destroy. But although the inhabitants of an ant's nest or a beehive may, and do, unitedly attack their common enemy, it is hardly to be supposed that a number of isolated insects such as the Psen, or the mason-bee, which have nothing in common with each other, and whose instinct teaches them to lead independent lives, should temporarily change their habits, become social, act in concert with each other, and dissolve their partnership as soon as they have accomplished their task.

The generic name, *Chrysis*, which is given to these insects is derived from a Greek word signifying golden, and appropriately belongs to insects whose bodies glow with such golden radiance. The common Fire-tail Cuckoo-fly is known to be parasitic in the nest of the wasp, and therefore may be reckoned among the gardener's friends. And it may be received as a rule that none of these fiery bees do any harm, and many of them do much good, so that they ought to be protected and encouraged wherever seen.

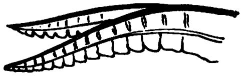
CHAPTER XIX.

SAW-FLIES—Their general Characteristics—Structure and Position of the Saws—The ROSE-FLY—Its Habits and Damage to the Roses—The GOOSEBERRY-FLY—Its Larvæ and their Voracity—Habits of the Grubs—"Dishing" Gooseberries—Ravages of the "Fly,"—The TURNIP-FLY and its various Names—Its Habits—Hatching and developing of the Grub—Its Numbers and Ravages—Various Methods of destroying it—Various Saw-flies and their Habits—The GIANT SIREX—Its Form and Colour—Its Habits—A mooted Question—Alarming Occurrence—Variable Dimensions—ICHNEUMON-FLIES—Their Shape, Structure, and general Habits—The LONG-TAILED ICHNEUMON-FLY—Power of the Ovipositor—Method of penetrating Bark—An old Myth verified—The MICROGASTER—Its Services to the Gardener—Destruction of Caterpillars—Structure of the Cocoons—A beautiful Nest—GALL-FLIES and their Ravages—The Oak and its Sufferings—The Ink Gall—Dead Sea Apples—Structure of the Gall and Development of the Insect—A fatal Error—Root Galls—Ichneumon-like Gall Insect.

THE insects which now come before our notice are those terrible foes of the gardener and the agriculturist which are known by the general name of SAW-FLIES, and various species of which are distinguished by the name of the vegetable on which the larva feeds, such as the Turnip-fly, the Gooseberry-fly, &c. &c.

The name of Saw-fly is very appropriately given to these insects on account of the remarkable apparatus with which they place their eggs in favourable situations.

If the reader will catch either of the above-mentioned insects, which are unfortunately only too common, and will look at the under side of the abdomen, he will perceive a longitudinal notched ridge extending to the end of the body. Then let him take a fine needle, insert its point under this ridge, and raise it, when he will find by the aid of a magnifying-glass that he has brought to view the singular double saw from which the insect derives its name, and which rests between two horny plates acting as a sheath. The shape of the saws varies much in the different species, but they all agree in having a delicate blade with obliquely-cut teeth, and a thickened back which enables them to play freely in the groove which directs their progress.



SAWS OF SAW-FLY.

These cutting instruments play in their common groove side by side, and work alternately, so that by their united action they rapidly make their way into the substances on which they are employed.

If we want to see the insect at work, we have only to watch by the side of the rose-trees, and look for the Rose-fly (*Hylotoma rosæ*), which may be easily recognised by reference to the illustration. Passing to the under side of the young shoots, she places the lower surface of the abdomen against the cuticle, and by the rapid play of the saws a groove is speedily formed. An egg is placed in the groove, and the insect moves on and cuts another slit just above the first. Some species make only a single series of these little grooves, while others cut two rows close together.

In several species of Saw-fly there is an acrid secretion which is poured into the slit, and causes the soft substances to swell so as to enclose the egg within them and to hold it firmly until it is hatched.

Towards the autumn, if the observer looks carefully at the leaves of many trees and shrubs, he will find their stems and the nervures on the under side covered with little notches. These are the grooves made by the Saw-flies, from which the young grubs have been hatched, and which have been baked into brown hardness by the summer's sun.

The larvæ of the Rose-fly are rather curious-looking creatures, and may be seen upon the leaves, with the body curved and elevated, and sometimes twisted so sharply as to resemble the letter S.

The Gooseberry-fly does not seem to make these grooves, but contents itself with placing its eggs upon the outer surface of the leaves, arranging them in rows like strings of tiny beads. The larvæ of this insect are greyish black grubs, which sometimes swarm to such an extent that the trees are stripped of their leaves, and nothing is seen but the black larvæ clustering upon the bare stems. The best method of ridding the gooseberry-bushes of this pest is by spreading a cloth under the boughs and striking them smartly, when the grubs will fall into the cloth and may be collected and destroyed.

The bushes will be easier freed from these pests if they have been properly "dished," *i. e.* if the central shoots have been cut away so as to leave the bush of a cup-shape into which the hand can be freely passed without danger of being scratched by the sharp thorns. Not only is the "dishing" an improvement by permitting the fruit to be gathered without risk, but it lets the air and sun have free access, and consequently develops a better and fuller crop of fruit than if the branches were allowed to grow after the ordinary straggling fashion, and to form a tangled mass of thorny boughs.

When the larvæ have attained their full growth, they form cocoons, in which they remain until they have reached their perfect state. Sometimes the larvæ descend to the ground and form their cocoons below the surface or under fallen trees, and sometimes they are content to attach them to the branches on which they have been residing. In the latter case, these objects become very conspicuous in the winter time, when the leaves have fallen and the boughs stand out gaunt and naked against the sky.

THERE are, perhaps, few insects which are so thoroughly injurious to the gardener and the agriculturist as the TURNIP-FLY (*Athalia centifoliæ*). The larva of this insect is the little, grey-black, many-footed grub, which is so well known under the various titles of NIGGER, BLACK CANKER, and BLACK CATERPILLAR.

Turnips are the vegetables which are most severely damaged by this insect, which has been known to destroy whole tracts of turnips, and force the farmer to plough up the land and sow it afresh. It is rather periodical in its visitations, though a certain number of insects are seen every year, and on an average, it seems, like the well-known periodical locust of Northern America, to appear at intervals of seventeen years.

Let us follow the progress of this insect from its birth to its death.

The mother Saw-fly searches among the turnips for a suitable leaf, and deposits her eggs upon it, settling upon its edge, and cutting with her saws certain little grooves wherein the eggs can lie safely until they are hatched. When the young first emerge from the egg, they are exceedingly minute, black, and hardly distinguishable as they creep slowly along the leaf. They are in that state able to feed only on the very young and delicate tissues; but they are so voracious, and grow so rapidly, that before very long they are ready to cast their skin, and pass through another stage of their existence. They cast their skin several times, and each time that they change their garments they increase in dimensions, and gain the power of extending their depredations.

They are very wary creatures, and, as soon as the plant on which they cling is touched, they loosen their hold, and drop to the ground, where they lie motionless until they fancy that the danger has passed away. When rain comes on, they retreat to the earth-burrow beneath its surface, and there lie until the shower has passed over. But if rainy weather should have set in, they find themselves obliged to choose between a wetting and starvation, and naturally prefer the former alternative.

When full-grown, the colour of the larva is shining black, with a slight grey gloss, and it is destitute of hair. It has twenty feet, *i.e.* six true-jointed legs, near the head, and fourteen short fleshy protuberances, called false feet, which enable it to cling more tightly to the leaves on which it feeds. During its last change of larval skin, it retreats from the plant and hides itself until it has undergone the change, and reappears as suddenly as it vanished, thus giving rise to the popular idea that these insects fall from the clouds.

After passing some three weeks in the larval condition, it ceases to feed, and prepares for its change into the pupal form. For this purpose it descends to the earth, and spins a cocoon, composed of silken fibres intermixed with particles of earth and sand on the exterior, so that it can scarcely be distinguished from the surrounding earth. Some of the insects emerge from the cocoon in three weeks, and set out immediately to lay the foundations of fresh colonies. Others, however, remain in their self-spun prisons until the following summer.

After it has remained within the cocoon for the appointed period, it bursts through its envelope, and emerges into the world in the shape of the Turnip-fly. A figure of this insect may be seen by reference to the illustration; and its colour is yellow and black. In the summer-time, hundreds of these insects may be seen flitting over the turnips, flying but short distances, and passing so incessantly from one plant to another that the air seems filled with them for a yard or so above the turnips.

The best plan of ridding the turnips of this pest is a subject of extreme importance, for the grubs are so numerous that fifteen or twenty may be found on a single plant. Various suggestions have been offered, such as steeping the seed in some solution, sowing poisons of various kinds in the furrows, but all with ill success; for the advocates of these schemes never seem to have reflected, that if the plants could thus be made poisonous to the caterpillar, they would be equally poisonous towards man.

Mechanical plans have also been tried in vain; such as rolling the ground, in hopes of crushing the grubs—a process which is tolerably effectual where the ground is hard, but quite useless where the soil is soft, as the larvæ are very tough-skinned, and if pressed into the ground by the roller soon emerge unhurt, and proceed afresh with the work of destruction. Trenches have been dug between the infested and free portions of the field; the farmer being ignorant that the eggs are laid by a flying insect, and that the grubs are perfectly capable of crossing any trench that can be cut. Lime and soot have been tried, without success, and as oil certainly destroyed every insect which it touched, but also destroyed the plant, its use was not thought advisable.

In a garden, there is no process so sure as hand-picking; but the pickers must remember that, if they are not very careful in their movements, the grubs will drop upon the ground, from which they can scarcely be distinguished. They should be at once dropped into a pan, containing the ammoniacal solution, which has already been recommended; for they care nothing for mere water; and if thrown into a dry vessel they are always crawling up the sides, and making their escape every time that the lid is raised. Children can be advantageously employed in this task, and paid a certain sum for every quart of grubs which they collect. Their little eyes are very sharp, and as from their height they scarcely need to stoop, they perform the duty better than adults could be expected to do.

A very excellent, and now tolerably well-known, remedy is to turn a supply of ducklings among the affected turnips. Those birds are very voracious, and when they are young they are very effectual in clearing the plants. It is necessary that they should be young, because, when they are full-grown, they are apt to eat the turnips as well as the grubs. The birds are therefore fattened in a very economical manner, and perform an essential service without requiring payment.

In some parts of the country there is an idea, that if rabbits eat the turnips which are infested by the Nigger, they became liable to entozoa in the liver. One writer on this subject offers a suggestion, that the "worm generated by the fly, which is a *tenthredo*, must, it would seem, be deposited in the shape of ova in the leaf of the plant, and in that form seems to be taken into the rabbit's stomach." Though how the egg of a hymenopterous insect could be developed into an entozoon, one of the lowest forms of animal life, is a problem which the writer in question does not attempt to solve.

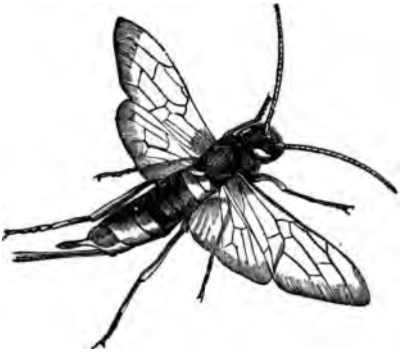
There is rather a pretty species of the Saw-fly which is injurious to the mustard plant, and is known to entomologists by the name of *Allantus dispar.* Its colour is black, with the exception of the tip of the abdomen, which is bright yellow. I believe that the larva of this insect does not form a cocoon, but contents itself with burrowing into the earth, near the plant on which it has fed, and there forming a small fragile cell of the earth with which it is surrounded. An allied species feeds upon the rose, and when the larva has obtained its full growth it burrows for several inches into the pith of the stem, where it finds a safe retreat.

ANOTHER genus of Saw-flies, known by the name of Selandria, is tolerably common in this country, and some of the species are very plentiful, feeding chiefly upon the leaves of trees. Between thirty and forty British species are known, and they all have rather long antennæ. A figure of one species, *Selandria salicis*, will be found in the illustration. Mr. F. Smith tells me that upon Hampstead Heath this insect is extremely plentiful, the larvæ dropping by hundreds from the trees. The larvæ of the different species of this genus are not always alike, and in many cases even the number of legs is different, those of some species having twenty-two legs, while in others the number is restricted to twenty.

The curious larva which in America is called the slug-worm, on account of the large quantity of slime with which the body is covered, belongs to this genus. A British species of this genus, *Selandria cerasi*, is remarkable for a similar phenomenon, the body of the larva being entirely covered with a mass of blackish green slimy substance, which exudes from the sides. This larva is a night-feeder, remaining quite still upon the leaves by day, and buried so completely in its strange covering, that no one who was unacquainted with the habits of the insect would imagine that beneath the viscid mass lay an active grub.

THE large and handsome insect which forms our representative of the next family is very plentiful in many parts of England, but is rather local, and apt to be periodical. It is local, because it is only to be found in the neighbourhood of the trees on which the larva feeds, but the reason for its periodical occurrence is not so easy of discovery.

This insect is not furnished with a saw, but the same parts are modified into a very curious and powerful boring instrument, which is able to penetrate not only into leaves and soft bark, but into solid timber. Fir-trees are preferred by the Sirex, which drills a small hole in the wood, and lays its egg therein. The egg is soon hatched, and from it proceeds a white, strong-jawed larva, which bores the tree in all directions, doing very great damage to the timber.



GIANT SIREX.—*Sirex gigas.*

Naturalists are not quite agreed upon one point. They cannot prove that it attacks or kills the living tree, but, at the same time, they are equally unable to disprove it. One thing is certain, namely, that whether or not it attacks the tree in its living state, it seriously damages the timber, sometimes riddling it to such an extent that it can only be used for firewood.

Not long ago I received a letter, together with a number of these insects, the correspondent stating that he had recently built a garden-house, and that the members of his family were annoyed by the continual appearance of these formidable-looking insects. I immediately conjectured that fir-wood had been used in building the house, and found, on inquiry, that the timber used in its construction had been obtained from a fir plantation in the neighbourhood. Most persons are very much afraid of this handsome insect, and it is frequently mistaken for the hornet by those who are unacquainted with insects and their habitations. It is, however, perfectly harmless; and though accounts have been published, wherein a number of men and beasts were stated to have been stung to death by the Sirex, such tales are totally unworthy of credit.

The tunnels which are cut by this insect are of rather large size, and very smooth, and remind the observer of the burrows made by the ship-worm.

In some of the fir-growing countries, very great damage is done by the Sirex, which perforates tree after tree, fills them with its burrows, and sadly deteriorates their value. Even in England it does no small harm in some seasons, and as it will continue to burrow long after the tree has been cut down, it may be reckoned among our enemies. Not unfrequently, logs of fir-timber infested with this insect are imported into England, sawn up, and used in buildings, without the discovery of the hidden insects. In process of time the larvæ pass through their pupal stage of existence, become perfect insects, and make their way out of the wood, to the great consternation of those who inhabit the houses. A lady complained to me lately that her kitchen was full of hornets, and, when the matter was investigated, it was found that new fir skirting-boards had been inserted, and that the creatures had issued from the wood, the holes remaining as evidence against them.

The Sirex makes a loud humming noise while on the wing. As is the case with most insects, the female is much larger than the male, and may at once be distinguished by the presence of the ovipositor, which is wanting in the opposite sex. Both sexes, however, are extremely variable in size, as is the case with nearly all the wood-boring insects, and some specimens are nearly twice as large as others. Those which had been developed in the timber used in the garden-house were remarkably small, while other specimens which I possess are as large as the figure on page 303.

There is a smaller species of the same genus (*Sirex juvencus*), which has very similar habits, and does nearly as much harm, burrowing into fir-trees and drilling them with tunnels, which, though not so wide as those of the larger species, are at all events as mischievous, and equally detrimental to the value of the timber.

We now come to a family of insects which has the best possible right to our protection.

It is a vast and comprehensive family, including within its limits some specimens nearly as large as those which have already been described, while others are so minute that they are barely visible to the naked eye. Indeed, the Ichneumonidæ among the Hymenoptera can only be compared to the staphylinidæ among the beetles for extent and variety.

Whether, however, they be large or small, they may always be distinguished by their gestures, which are of a very similar character throughout the family, and are so peculiar as to arrest the attention of any one who is acquainted with the habits of these insects. They are seldom still for an instant, but run about in a quick, fussy kind of manner, turning this way and that way—now a few paces to the right, now as many to the left—sometimes fluttering their wings as if they meant to take to the air, and then closing them with a quick decided ruffle, as if they meant never to use them again. Sometimes the insect pauses for a moment or two, in order to examine some particular spot; but, whether it is running or standing, its antennæ are always on the move, quivering with incessant vibration, and giving to the creature an air of sprightliness that is peculiar to the Ichneumons.

The insects which compose this family are all parasites, and are parasitic in a very remarkable manner. We have already seen instances where one insect invades the home of another, and introduces an interloper, which either destroys the rightful owner by devouring it, or eats its stock of provisions, and so forces it to die of hunger. But here we have a new mode of proceeding, where the egg is laid, not in the home of another insect, but in the very insect itself—mostly while in its larval condition, but sometimes while it is still in the egg. The larvæ of moths and butterflies are peculiarly liable to these attacks.

About fifty or sixty eggs are often placed within the skin of a single caterpillar, and are hatched, and pass the greater part of their lives within its body. No external signs appear to indicate that the caterpillar is harbouring such a host of internal devourers. It feeds as usual, changes its skin as usual, grows as usual, looks fat as usual, and appears in perfect health. Appearances are, however, deceptive in this case, as in others. If the body of the caterpillar be opened, the apparent fatness will be found to consist of the bodies of the larval Ichneumons, which occupy the space rightly belonging to the fat, and give to the outline a deceptive and fatal plumpness.

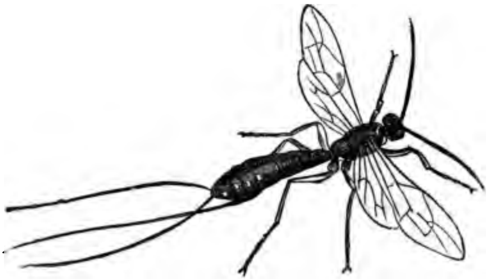
Strange to say, the caterpillar seems nothing the worse for this host of inmates, which are taught by their instinct to avoid the vital organs, and to draw their whole nutriment from the fatty substance amid which they are laid. Generally, no indication of their presence is given until the caterpillar ceases to feed and is about to undergo the change into the pupal condition. No sooner does it cease to feed than the concealed larvæ burst through the skin on all sides, and the caterpillar perishes. Even then it does not seem to die so much from the effects of violence as from the fact that the Ichneumons have eaten all the fatty substance which was intended to form its nutriment during its quiescent pupal condition, and so the creature perishes from sheer exhaustion.

In so limited a work it will be impossible to mention more than a few typical species of Ichneumon Flies; for if all the British examples were to be described, the whole of this volume would not furnish half the requisite space.

THE large and handsome species which is here represented of its natural size is a most valuable ally to mankind. It chooses as the *nidus* for its eggs the larva of the smaller Sirex (*Sirex juvencus*), an insect which might be thought perfectly safe from all such attacks, deeply sunken as it is in the hard wood, and leaving no external trace of its whereabouts.

The Long-tailed Ichneumon, however, is gifted with instincts which enable it to discover the locality of the hidden larva, and with instruments which permit it to pierce its body and deposit its egg therein. It runs up and down the trunks of the fir-trees, patting the bark with its antennæ, and traversing every inch of space like a pointer quartering his ground. Taught by some subtle intuition, the Ichneumon discovers the presence of its prey, and immediately sets to work to pierce it.

Any one, on looking at the Ichneumon, would at once ask how it would be possible for the creature to reach the concealed grub, defended as it is by a barrier of hard wood. Such, however, is the task set to the insect, and it is a task which is fulfilled with an ease and power that strike the observer with admiration. The three long and slender filaments which proceed from the end of the abdomen, and are scarcely thicker than the hairs of the human head, form the instrument by means of which the creature is enabled to bore through the hard wood. The central filament is the instrument by which the boring process is accomplished, and the others form the sheath by which it is guarded.



LONG-TAILED ICHNEUMON FLY.—*Rhyssa persuasoria.*

How this feat is performed is so clearly narrated by Mr. Westwood, while describing the proceedings of an allied insect, that I must be pardoned for giving his own words. "I observed a *Pimpla* with the ovipositor about as long as the body, in the act of oviposition in a dry paling, which had been much perforated, and out of which I had just dug a black pemphredon. The part in which the ovipositor was introduced appeared to be quite solid. (Reaumur represents his specimens as inserting their ovipositors in a circular patch of dried clay, used to stop up the entrance to the nest of the intended victim.) There are several very minute blackish spots, as they seemed to be, close to the place where the ovipositor was inserted, and which were probably other places of insertion of the ovipositor.

"When first observed, the insect had introduced about half the terebra (*i. e.* the boring instrument) into the post, the part remaining uninserted being at a right angle with the body, the sheaths being curved, and their tips being brought to the place of insertion, thus evidently strengthening the terebra in its operations. The abdomen was at this time alternately turned from left to right and *vice versâ*, whereby a bradawl kind of motion was given to the terebra, enabling it to penetrate the wood to a greater depth. It then alternately partially withdrew and replunged the terebra into the hole thus made, as though in the act of passing an egg or eggs, standing all this while on the tips of the tarsi."

The Long-tailed Ichneumon is so eager at this business, and plunges the borer to such a depth, that it is often unable to extricate itself, and may be seen fixed to the tree by its own sting, thus carrying out the old fable of Milo and the cleft tree.

It is a noteworthy fact that even the larvæ of these Ichneumons are liable to the attacks of other Ichneumons, which are thus parasites upon parasites, and the larva of the Pimpla is in its turn devoured by that of the Ophion, another of the Ichneumon flies. I may mention here that several observers consider that all the three portions of the ovipositor are needed in boring into the tree.

Of all the Ichneumons which a gardener has reason to praise, a very little species, with a very long name, is perhaps the most worthy. It is known to entomologists as *Microgaster glomeratus.* The former of these two words is of Greek origin, signifying "little belly," and is given to the insect on account of the small comparative size of the abdomen; while the latter name is Latin, and is given because the cocoons in which the pupæ lie are all gathered together in a mass.

It is a very minute insect, scarcely so large as the letter t, and appearing to the unassisted eye to be quite black, with simple transparent wings. But when this insignificant little being is placed under the microscope, and properly illuminated, it seems to have undergone a transmutation, and blazes out in most glorious apparel. The tiny black body, that looked as dull as if it had been rubbed with printer's ink, now shines out in metallic splendour, glittering with an intensity which the eye can scarcely bear, and covered with multitudinous pits, like those at the end of a lady's thimble, which greatly add to the brilliance and depth of the general colouring.

The little wings, that scarcely looked like wings before they were placed under the microscope, now appear in all their beauty, their surface glorious with opalescent hues playing upon them with every change of light, and covered with the minutest imaginable hairs, each of which glitters separately, and gives its aid towards producing the beautiful opalescence which has just been mentioned.

This little insect preys almost entirely upon the caterpillars of the white butterfly, so plentiful in our gardens, and serves a most important purpose in checking their increase. Tiny though it may be, it can destroy the caterpillar as certainly as if it were a giant; and the caterpillar, which is to the Ichneumon what a whale is to a man, falls an unresisting victim to a creature whose parts we can scarcely distinguish with the naked eye.

The Microgaster deposits a very large number of eggs in each caterpillar, from which are hatched little white grubs, nearly transparent and with a delicate filament proceeding from their extremity. As this filament lies among the fatty matter of the caterpillar, some entomologists think that the nutriment is partly obtained by its means. The percentage of caterpillars which are attacked by this Ichneumon is very large; I might almost say that the percentage of those which escape is very small. To the dissector they are very useful assistants; for they devour the fat, which is one of the chief obstacles in dissecting insects, and as they lie loosely among the tissues just under the skin and external muscles, they are removable without difficulty.

When the caterpillar has reached that stage of existence in which it ought to change into a pupa, it leaves the cabbages on which it was feeding, and creeps away in order to find some favourable spot for undergoing the transformation. That change, however, it never makes; for out come all the ichneumon larvæ, spin little oval yellow cocoons round the body of the insect in which they lately resided, and not unfrequently sustain the lifeless body upon the mass of cocoons.

These are very pretty objects even to the naked eye, and will bear examination by the microscope, under which instrument they bear a decided resemblance to the cocoons of the silkworm. There is another Ichneumon fly that is parasitic upon the Microgaster, and it is a rather curious fact that the parasite is three times as large as the insect on which it feeds. I have often bred them from the cocoons of the Microgaster; and have seen them running about the yellow masses with great perseverance, patting the cocoons with their antennæ, and seeming to search for favourable spots wherein to deposit their eggs.

An allied species, *Microgaster alveolus,* is remarkable for the beautiful cocoons which are spun by the larva, and the manner in which they are arranged. Instead of being thrown together without any order, as is the case with the last-mentioned insect, they are ranged regularly side by side, and look very like minute honeycombs, with a single, instead of a double row of cells. These cocoon masses are fixed by one of their edges to twigs and branches, so that the inmates lie horizontally. Several of these clusters now before me were taken from lilac branches in a small garden at Greenwich.

When the inclosed insects have passed though their quiescent pupal stage of existence, they nibble in a circular direction round one end of the cell, so as to cut out a little opening through which they can make their escape. Sometimes the circular piece which is cut out by the teeth is altogether removed, but it generally adheres on one side by means of the silken fibre of which the cell is constructed, and which acts as a hinge. Although the separate cells are not nearly so large as those of the preceding species, the insect which inhabits them is very much larger. The difference in the dimensions of the cells is, however, more apparent than real, those of the former species being covered with a loose coating of yellow silk, while those of the present species are tight, close, smooth and compact.

The long, sting-like ovipositor of many Ichneumon flies is a very formidable weapon to the eye, but in reality it has no terrors, being slender, delicate, and without poison. When roughly handled, the Ichneumon will certainly press the point of the ovipositor against the skin of the hand, and go through the motions of stinging with wonderful fidelity. But there is really nothing to be feared from the insect, for the ovipositor will not pierce the skin, and even if it should do so, no more pain would be felt than is inflicted by the prick of a very fine needle.

There is scarcely a caterpillar, whether of moth or butterfly, that does not suffer from the attacks of some Ichneumon. Those who are fond of collecting and breeding the beautiful lepidoptera of our island, are frequently annoyed and disappointed when a rare and valuable caterpillar which they have reared with the greatest care, and to which they were looking to produce a fine specimen of the perfect insect, suddenly dies, the cause of death being visible in the shape of a few small circular holes made as if with a drill. I have bred from the caterpillar the greater number of the British butterflies and larger moths, and may safely say that, from the peacock butterfly and death's-head moth down to the smallest species of both groups, I have lost valuable specimens through the Ichneumon flies.

The entomologist has, however, his revenge; for, if he has taken the precaution of placing the pupa in a vessel covered with fine wire gauze, he will, in process of time, make a most valuable collection of the various Ichneumon flies, and will be able to ascertain the creatures on which each species feeds.

We must pass by many other British Ichneumons, and their allies, the Chalcididæ—little creatures which are valuable to gardeners because they destroy the aphides and scale insects—and come to the larger family of the Cynipidæ, or GALL-FLIES.

We have all seen the galls upon various leaves, and admired their varied forms. The oak is an especial favourite of the Gall-flies, and exhibits a wonderful variety of these curious developments. There are the well-known oak-apples, large, soft, and ruddy cheeked, which, when gilt, are in such very great estimation on the 29th of May. Others are globular, green, and quite hard, and adhere firmly to the branches, as if they were really fruit. Others again are affixed to the nervures of the leaves, thin-skinned, polished, pinky, and semi-transparent; while others cluster in strings from the twigs just like bunches of currants.

Some galls again, such as the well-known bedeguar of the rose, with its bright green and carmine tinting, throw out long and delicate filaments, while others give birth to a number of leaf-like scales, which closely resemble the common artichoke. The stems of plants are attacked by the gall insect, and swell uncouthly, as if visited by a vegetable modification of the gout; and even the roots of trees are not free from its visitations, being often covered with knobs and excrescences, which, when opened, are found to contain the larva of a gall insect.

To rear the insects from the larvæ is not a very easy task unless the tree on which the galls are placed is within the garden. In that case, the simplest plan is to inclose the leaf or gall within a double gauze bag, so as to entrap the inmates when they make their escape. In any case, duplicate specimens should be placed in spirits of wine, so as to show their larval and pupal forms, as well as to preserve the structure of the gall; and a coloured sketch should be taken of the gall, in order to counteract the bleaching properties of the spirits.

When the trees are not within our domains, the best plan is to select those galls which appear to be furthest advanced, and to cut the branches on which they are fixed, so as to allow them to be placed in water and kept in a green state as long as possible.

If this precaution be not taken, the gall is sure to shrivel up, and the inclosed insect either dies for lack of nourishment, or is stunted and ill-grown when at last it makes its appearance.

Some of these insects are extremely useful to mankind, and as none of them do any real harm, they may all be protected. The species which confers the greatest direct benefit on mankind is that which produces the galls from which ink is made. The technical name of the insect is *Cynips Gallæ-tinctoriæ*, and the tree on which the galls are found is a species of oak, *Quercus infectoria*, growing in the Levant.

The galls are nearly round, and about as large as boys' playing marbles, and covered with tubercles on the outside. They are most valuable just before the insect has made its escape, and in that state are called black, blue, or green galls; but after the inclosed grub has gone through its transformations, and gnawed its way through the fabric in which it was bred, the galls lose much of their astringency, and in consequence are of less value. In this state they are called white galls. There is only one grub in each gall.

The same tree that bears the galls of commerce is also remarkable for another kind of gall, which is popularly known by the name of Apples of the Dead Sea. Legends have existed for many years respecting these far-famed apples, which were thought to have been smitten at the time when the fiery deluge descended upon the evil cities; and, though tempting to the eye, and with a fair exterior, to be interiorly filled with bitter dust and ashes.

These accounts were long thought to be fables, in spite of the narratives of many eye-witnesses, but are now known to be based on truth, the so-called apples being in fact the galls of an insect, which have a beautiful smooth and delicately tinted exterior, not unlike that of a ripe apple, but are of course bitter and astringent within. Any one who wishes to know the flavour of the Apple of the Dead Sea may do so by the simple process of tasting a little dried ink.

How the galls assume their shape is rather a problem, though it is well known that the presence of a poisonous juice is the exciting cause. The maternal insect is furnished with a boring instrument, not unlike that of the ichneumon, consisting in like manner of a central terebra, and two external valves which act as a sheath. With this compound instrument the insect penetrates the leaves, twigs, stem, or root of the plant upon which the gall is to be found; and in the hole thus made she places an egg, together with a drop of some irritating fluid. The effect of this liquid is very potent, causing the substance of the plant to swell in an astonishing manner, so as to inclose the egg in its centre.

Such are the effects of this irritating substance; but the mode of its action is by no means understood. If the effect of an irritating fluid were merely to cause the substance of the plant to swell, we might naturally imagine that all galls produced on the same plant would resemble each other. Such, however, is not the case; for there is a marked dissimilarity between the galls produced by different insects, even though they are formed on the same tree, and consequently from the same juices. The apple and the currant are scarcely more dissimilar than the common oak-apple and the currant gall, both of which are produced upon the oak by means of this irritant poison; and, moreover, the insects which cause the excrescences are closely allied to each other.

In due time, after the egg has been placed within its strange cradle, the larva is hatched; a little white grub, mostly curved like the maggot in a nut, and equally fat. It is a voracious little being, and feeds luxuriantly upon the food with which it is surrounded until it is just about to pass into the pupal state, when it ceases to feed, and remains quiescent until it has gained its wings. It then eats its way out of the gall, and makes its entry upon the world.

Many galls contain only a single insect; but in others, such as the oak-apple and the bedeguar, there is quite a colony of these little creatures. Some are moderately large and rather dull in colouring, while others are small and of the most brilliant hues, their bodies glittering with green and azure, and burnished like the armour of an ancient knight.

The eggs of the Gall-fly are very small, or they could not be introduced into the tiny hole which is made by the boring instrument. But, after they have been deposited, they actually seem to draw nourishment from the substance in which they are inclosed, and increase notably in dimensions. A similar phenomenon takes place in the eggs of the saw-flies. Many of the species are liable to the attacks of the ichneumon flies, which are able to pierce through the substance in which they are inclosed, and lay their eggs in the soft white body within. If the gall be cut open when the insect has attained its full growth, the portions immediately round its body will be found to be of a harder and more woody consistence than the rest of the gall, and to form a definite cell in which the creature lies inclosed.

The insect sometimes makes a mistake in attempting to make its escape from the cell. I possess a rather curious example of this error. Two galls had sprung from the same twig, and their walls had been fused together at one point. From one of the galls the insect had made its escape, but that which inhabited the other gall gave no sign. After a lapse of some weeks I carefully cut the two galls open, in order to ascertain the cause of the delay, thinking that by some chance the second insect might have got into the passage through which the other had made its way.

On opening the gall, however, the cause of the delay was apparent. The unfortunate insect had been developed with its head turned in the wrong direction, and, by some strange mischance, it had directed its course through the spot where the two galls joined each other. It had been able to make its way through its own home, and partly through that of its neighbour, where I found it lying dead, its strength not having sufficed to enable it to perform a double labour.

The largest societies of Gall insects appear to be those which live in the roots of trees, more than a thousand insects having been obtained from a single specimen formed on the root of an ash-tree. Perhaps we are hardly justified in using the word "society," while speaking of these galls; for though a very large number of insects are formed in the gall, each insect has its own cell, and leads a life as isolate as if it were the sole inhabitant of the gall.

Mr. Westwood mentions that some species of this family are parasitical upon other insects, and that he not only saw a very minute species of Gall-fly in the act of depositing its eggs in the body of a rose aphis, but that he succeeded in hatching specimens of the perfect insect from the infested aphides. Several species of Gall-flies have this remarkable habit, and various aphides, such as those of the willow and the cow-parsley, have been seen to suffer from the attacks of the Gall-fly. These species are extremely minute, scarcely one-twentieth of the size of the aphis in which they lay their eggs.

CHAPTER XX.

LEPIDOPTERA.

Lepidoptera –Their General Structure and Development—Reason for their Name—Butterflies—How Distinguished—Use of Natural History to the Gardene —A Practical Rule—The White Cabbage Butterfly and its Ravages—Methods of Destroying the Caterpillar—Food of the Caterpillar—Its Development and Mode of Passing the Pupal Stage—Small White Butterfly—Its Larva—The Food and Habits of the Caterpillar—Green-Veined White Butterfly—Its curiously Coloured Larva—Times of its Appearance—The Wood White Butterfly—Colour and Shape of the Larva—Food of the Caterpillar—Black-Veined White Butterfly—Eggs of this Insect—The Larva, its Food and Development—Peacock Butterfly—Its Splendid Colouring—The Larva and its Habits—Its Value to the Gardener—Colour and Shape of the Larva—The Scarlet Admiral—Colours of the perfect Insect—Its Peculiar Habits—The Larva and its Food—The Small Tortoiseshell Butterfly—The Larva, its Gregarious Habits, its Food, and its Colouring—The High Brown Butterfly—Its beautiful Colouring—Shape, Colour, and Food of the Larva—Wood Argus Butterfly—Its Colour—Food of the Caterpillar—Its Value to the Gardener—Colour and Shape of the Larva.

With scarcely a single exception, the whole of the species belonging to the order of Lepidoptera, *i. e.* the Butterflies and Moths, are injurious to vegetation, so that we might swell our list of garden foes to a very great extent. I have, therefore, only selected a few of the most prominent examples from this great order, choosing those species which are most frequently found in the garden, and work the greatest damage within its walls.

Before we examine the history of the several species, it will be as well to cast a rapid glance at the general characteristics of the order.

They are called Lepidoptera, or Scale-winged insects, because their wings are covered with minute scales, which appear to the naked eye like fine dust, but which, when examined under the microscope, exhibit a delicacy of structure and variety of form, that never fail to excite admiration. These scales are set upon the wing in a very regular manner, overlapping each other like the tiles of a house; and even after they have been removed, row upon row of little scars mark the spots where their roots have been fixed.

All insects pass through three definite stages of existence after they have been hatched; namely, the larva, the pupa, and the perfect insect, technically called the "imago;" but in the Lepidoptera these three stages are defined with a conspicuous boldness, which has for many ages attracted the admiration of all who love to examine the works of nature.

It is true that in two of the orders which have already been described, namely, the coleoptera and hymenoptera, these changes are very clearly marked; but they are not nearly so conspicuous, on account of the habits of the insects. The beetles, for example, always seek the most retired spots in which they can pass through the larval and pupal stages, while the generality of the bees, wasps, and other hymenoptera are tightly inclosed in cells, so that we scarcely ever see the insect until it has attained its perfect form. But, as a general fact, the whole life of the butterfly or moth is passed in the open air, and its proceedings can be watched, from the moment when it quits the egg to that in which it shakes off the dry chrysalis shell, and spreads its wings to the breeze, a new denizen of air.

The larvæ of the Lepidoptera are essentially vegetable feeders, although, under certain circumstances, they have been known to eat each other. A few of them burrow into trees, but the greater number of species are found exclusively upon the leaves or within the flowers, passing thence into the fruit, and marring its perfection.

It is only in the larval state that the insects inflict any damage upon us, as they lie perfectly motionless while pupæ, and when they attain their perfect form, their mouths have no jaws, and their only food consists of the sweet juices of flowers, which they suck through a long and delicate proboscis. Many species are devoid even of the proboscis, and are totally unable to eat even honey, the whole of the nourishment having been taken into the body while they were in the larval condition.

Such being the case, the larva must eat largely while it retains the power of so doing, in order to lay up a store of fat which will suffice for its subsistence not only during its change into the perfect state, but until it has discharged the great duty of its life by laying the foundation for a future generation. Large and small, the caterpillars—as the larvæ of these beings are called—are exceedingly voracious, and devour rapidly the substances on which they feed. I was never able to appreciate the vast amount of vegetable matter consumed by caterpillars, until practical experience engraved it on my memory. At one time I kept rather more than a thousand caterpillars of different species, and was obliged to supply them with food by personal labour.

It was really hard work to do so, and sometimes I was on the point of giving up the experiment. A whole armful of foliage vanished in an hour or two, and nothing was left but a quantity of bare sticks. As I sat in the room, the busy jaws of the caterpillars were perfectly audible as they crunched the leaves, and their cessation only gave me warning that the creatures wanted more food.

The BUTTERFLIES, which are rightly placed at the head of the Lepidoptera, are all diurnal insects, and are mostly gifted with bright and varied colouring, as befits these children of the day. Even those which appear to be of rather sombre hues, will prove, when examined, to be decorated as gorgeously, though perhaps not so conspicuously, as their more gaudy companions; and we frequently find that if the upper surface of the wings be of sober tints, the lower surface is variegated, and *vice versâ.*

The knowledge of the habits and transformations of all insects is valuable to the gardener; but there is, perhaps, no order of insects which has such claims on his attention as this which we are now examining. Ordinary working-gardeners have wonderfully few ideas upon so important a subject, probably because the cause and effect are so far apart. They are fully aware of the noxious properties of snails and slugs, and kill them whenever they see them. They are acquainted with the damage done to plants by many caterpillars, but there are very few of them who try to find out the customs and habitations of these creatures, so as to cut off the supply at the fountain-head. They will destroy every caterpillar they see, but they know little about the perfect state of the insect, and are apparently unconscious that, by killing a single female, they practically destroy as many caterpillars as she would have laid eggs. So with other insects. They know and fear the wireworm and the "nigger," but they seldom know that the parent of the one is a beetle, and of the other a saw-fly, and that much corn and turnips might be saved through a knowledge of these insects and their habits.

We will now glance at a few species of these Butterflies. Which may we spare, and which must we kill? A very short rule will suffice, so far as the garden is concerned. All the white butterflies are hurtful, most of the coloured butterflies are neutral, and some are beneficial, and ought to be accepted as allies.

The worst of all these creatures is the great WHITE CABBAGE BUTTERFLY (*Pontia Brassicæ*), which may be known by its large size and the black spots on the wings. This creature may be doomed to death as soon as seen, for it is one of the most pernicious of the winged pests. Many persons who would crush the cabbage caterpillars by the dozen, and think that they had done their duty towards the garden, have great scruples about killing this "pretty harmless creature," as they call it, and think that any one who destroys it is committing an act of great cruelty; yet, in truth, the destruction of life is much smaller, and the infliction of pain much less, than if she had been allowed to lay her eggs in safety, and then that the numerous caterpillars hatched from these eggs should be killed. Moreover, it is by no means certain that the quick and unexpected death which the insect would suffer is not as merciful a fate as its usual end—namely, to be eaten by birds or predaceous insects.

Every one who has cultivated a kitchen-garden, or has even purchased a cabbage at a greengrocer's, must be well acquainted with the caterpillar from which this butterfly is developed, with its green, yellow, and black body; the first tint being the ground colour, the second arranged in three longitudinal lines, and the last spread over the whole body in a series of small black points, each with a hair in the centre. It is a most noxious creature, voracious, destructive, and noisome of odour.

When I was a small boy, my parents were accustomed to set us to picking the caterpillars out of the cabbages, paying at the rate of a halfpenny per flowerpot-full. We earned plenty of pence, but at the cost of much disgust; for the smell of the caterpillars was horrid, and our hands required no small amount of ablutions before they could be cleansed from the odious effluvium. Moreover, they left such abundant and noisome traces of their presence in the leaves, that for a long time I could not bring myself to touch a cabbage, no matter how carefully it had been washed.

The only way to clear the vegetable wholly from these pests, and prepare it for the kitchen, is to strip it of the outer leaves, put it into a vessel, with a saturated solution of salt, and then rinse it under a tap, taking care to hold the leaves well apart, so as to permit the water a free passage. A sprinkle with salt, and a second rinse will do no harm.

The cabbage is the usual food of this unpleasant caterpillar, but the creature will feed on many other plants, and in default of its usual diet, will infest that most persecuted of plants, the turnip. The broccoli and the cauliflower are also much damaged by this caterpillar.

I have already mentioned that to kill the parent insect is one of the best modes of thinning the broods of caterpillars. May is the best month for this operation, as they have not then begun to lay their eggs. It is impossible, however, to debar winged creatures, so small and so numerous, from all access to the garden, and rather late in the year the eggs may be seen sticking in little patches on the cabbage-leaves. All these eggs should be destroyed, and it will be found that this simple precaution will have a wonderful effect in diminishing the numbers. As for those that escape and are hatched, the best plan is to resort to careful hand picking. Many birds will give their aid, especially when their young are hatched, and getting very hungry; but there is no remedy like hand picking, for the caterpillars are no travellers, and when a patch of cabbages has been fairly cleared, it will not be visited by new importations.

When the caterpillars have completed their eating, they leave the plant whereon they had lived, and make for a wall, palings, or other perpendicular object, there sling themselves head downwards, and pass into the pupal state. Hundreds of the pupæ may be seen on every wall towards autumn, and are easily killed. This butterfly is most prolific, and but for the exertions of the small birds and the ichneumon flies, would soon devastate our gardens. Of both these garden friends we shall have something to say.

There are several other white butterflies that inhabit England, but we need only consider two of them. The first is the **Small White Butterfly** (*Pontia Rapæ*), an insect that bears a great resemblance to the cabbage butterfly, but is much smaller.

Although the caterpillar of this butterfly is not so unpleasant to the eye and nostril as that which has just been described, it is nearly as destructive, and answering to its colour and the manner in which it feeds. The colour of this caterpillar is bright green, diversified with a paler streak along the back, and a white line, minutely spotted with yellow, on each side of the abdomen. The cabbage caterpillar is tolerably conspicuous, but this creature insinuates itself into the very heart of the cabbage or cauliflower, and so closely resembles the leaf in colour, that it is not very readily seen.

It also feeds much upon the mignonette. I have had several boxes full of this sweet-scented flower greatly damaged by this larva, which contrived to conceal itself so effectually among the green leaves and pendent seed vessels, that it could scarcely be distinguished from them. I caught and immolated numbers of these larvæ, but in spite of all my vigilance many escaped, and changed into the pupal state before I discovered them.

At least two broods of this butterfly are hatched every year, and it is not unlikely that in a warm season their number may be increased. Birds are very fond of this caterpillar, toads will eat it greedily, and a tame chameleon which lives in my room, has just swallowed a couple of them. This is rather an earlier insect than the cabbage-butterfly, the first brood appearing in April. The last brood is seen about July or August. I may here mention that it is easy to distinguish insects of a late or early brood by merely looking at the wings. If the edges of these organs are torn, ragged, and shabby, the entomologist knows that they belong to an insect of the early brood, which has been battered about in the world and lost its pristine beauty. If, on the contrary, the edges are perfect and rounded, the insect belongs to a late brood, and in all probability is not more than a day or two old.

Another example of the white butterflies, belonging to this genus, is the GREEN-VEINED WHITE (*Pontia Rapi*). This is a small species, not two inches wide across the wings, and very conspicuous, having the nervures of the wings tinted with green. The caterpillar is green, like that of the preceding insect, but may at once be distinguished by the lighter hue of the sides, and the multitude of little protuberances which stud the body, white, with black tips, and tufted with hairs. This caterpillar is found plentifully upon many of the cruciferous plants, and is a terrible pest to the cabbages. It is one of the commonest British insects, and makes its first appearance in May. A second brood is generally seen in July and August. Like the other white butterflies, it is subject to much variation in colour.

The smallest of the white butterflies is easily known by the narrowness of its wings. It is popularly known by the name of WOOD WHITE, and scientifically is called *Leucophasia sinapi*. The caterpillar of this butterfly is green, with a darkish yellow stripe along the sides. It does but little harm in the gardens, though it is somewhat destructive in the field, feeding on the trefoil and vetches. It is thought to be a rather scarce species, and is certainly very local, appearing in multitudes at some favoured spot, but being seldom seen in neighbouring localities.

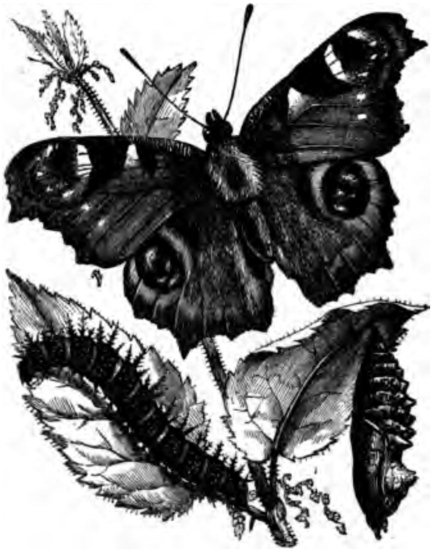
The BLACK-VEINED WHITE, sometimes called the HAWTHORN WHITE, is another example of the destructive butterflies, though its ravages are confined to the hedges, and occasionally to the fruit-trees.

The reader will probably have noticed a curious appearance on the twigs of the hawthorn, namely a bracelet, as it were, of little beads set closely together and tightly glued to the bark. These are the eggs of the Black-veined White Butterfly, and are so beautifully protected with water-proof varnish that they remain in the most exposed situations until the weather is warm enough to hatch the young caterpillars. These are at first black, tiny little things, but in a short time become beautifully coloured with pinky-brown and blackish dots. The caterpillar feeds on the leaves of the hawthorn, and is one of the gregarious creatures, a number of them assembling together, protected by a network common to all. In this country it is not sufficiently plentiful to do much damage, but on the Continent it is sometimes very numerous; it frequently is extremely mischievous, destroying the hawthorn, and covering whole orchards with its silken meshes. The chrysalis is yellow, curiously striped with irregular bars of black, and dotted with the same colour. It is partly suspended by the tail, and fastened by a silken thread over the body.

The perfect insect cannot be mistaken, the bold black veinings on the white wings being sufficient to distinguish it from any of the other white butterflies. Round the outer edge of the wings is a narrow black line, and each wing is surrounded by a strong nervure. In size it is about equal to the cabbage butterfly.

THERE are so many British butterflies that even an enumeration of their names is impossible in this little work. Few, however, enter gardens, the greater number being localised, and keeping themselves to their native woods or heaths. Most of them may be reckoned among the neutrals, and, being entitled to the benefit of their neutrality, may be spared from destruction; but there are some few whose usual home is in the woods or field, but which occasionally enter the gardens when the requisite conditions are present, and there perform good service. Let these be honoured guests and cherished, for they are not only beneficial to the gardener, but are among the most beautiful of the British butterflies.

The well-known PEACOCK BUTTERFLY (*Vanessa Io*) is one of these friends. The splendid colouring of this butterfly is well known, and seems to gain rather than lose in effect by contemplation. Nothing more richly artistic can be imagined than the grouping of tints on the upper surface of its wings, and nothing more curiously combined. Given the following colours, warm chestnut red, yellow, blue, black and brown, how difficult is the task to combine them with such harmonious and yet bold effect as is seen on the wings of the Peacock Butterfly.



PEACOCK BUTTERFLY.

The caterpillar of this insect is black, with a great number of little white spots. It feeds upon the stinging-nettle, and devours great quantities of this unpleasant vegetable. I have had numbers of Peacock Butterflies, and have been surprised by the quantity of nettle-leaves which they would eat.

Several other handsome butterflies are fellow-feeders on the nettle. One of them, the SCARLET ADMIRAL (*Vanessa Atalanta*) is next in beauty to the Peacock Butterfly, and by many persons is thought even to surpass that insect in the splendour of its colours. Certainly, there are no British insects which present so magnificent an aspect as does the Scarlet Admiral, with its black wings edged with azure crescents, and the blood-red band drawn across both pairs of wings. The under side of the wings is covered with a peculiar marbled pattern of similar hues to those of the upper surface, but of a paler cast. It is one of the later butterflies, being most plentiful in the months of July and August. It has a strange fondness for the flower of the teazle, and loves to sit swaying in the breeze on the pale purple blossoms. The peacock and large tortoiseshell butterflies have a similar habit.

The caterpillar of this butterfly may be found plentifully upon the stinging-nettle, mostly reposing in the midst of a bunch of leaves, which it has drawn together with its silken threads. Its colour is very deep olive-green, approaching to black, with a yellowish broken line along each side. The flight of this butterfly is swift, smooth and graceful, and often very like that of the swallow, the insect wheeling round upon motionless wings, and guiding its course by the sway of the body. For this reason the creature has been named the Atalanta, in honour of the swift-footed nymph who lost a race and won a husband.

The SMALL TORTOISESHELL BUTTERFLY (*Vanessa Urticæ*) is another of the useful visitants of the garden, for it feeds upon the same venomous plant as the two preceding species, and, on account of its numbers and voracity, destroys nearly as many nettles as the peacock and atalanta caterpillar together. The larvæ of this pretty butterfly are gregarious, assembling together upon the nettle, and drawing together the leaves with the threads that they are enabled to spin. The leaves are not arranged in any particular order, but merely drawn loosely together, and as soon as a company of caterpillars have eaten one tuft of leaves, they proceed to another, wind their threads round it, pull the leaves together, and recommence their ceaseless task of eating. In districts where nettles, and consequently the Tortoiseshell Butterflies, are plentiful, whole patches of these plants may be seen, stripped of their leaves, and exhibiting only masses of gaunt and naked stems, with patches of withered leaves hanging here and there, riddled with holes, as if cut to pieces by shot, and dangling by the silken threads which the caterpillars have spun. Others stand out, dark, apparently, with thick leafage, but swaying and bending in a curious fashion, as the wind sweeps over them. On a closer inspection, these nettles are found to be covered with the caterpillars of the Tortoiseshell Butterfly, hanging in masses like the Singhalese leeches upon the traveller's feet, and looking black and dark like bunches of old leaves. When they are about half grown, they find that feeding in company will not answer their purpose, and therefore separate and seek independent livings. Their colour is then black, striped longitudinally with yellow, and the body is covered thickly with curiously formed branched spines, that look as if small twigs had been inserted into the skin. What is the object of these curious spines is not quite certain, though some persons suppose that they are intended to preserve the body from being pierced by the stings of the plant on which the caterpillar feeds. This supposition is, however, quite insufficient to account for the spines. As to the GREAT TORTOISESHELL BUTTERFLY (*Vanessa polychloros*), it is so comparatively scarce, that it may be considered as a neutral, the caterpillar feeding on the willow, elm, wild cherry, and a few other trees.

The beautiful insect which is known to collectors by the name of the HIGH-BROWN FRITILLARY (*Argynnis Adippe*) is one of the exceptions to the general rule concerning the coloured butterflies.

The caterpillar feeds upon two of our valued plants, namely, the heartsease and the sweet violet, and ought, therefore, to be destroyed whenever it is found in a garden. It is a prettily-coloured creature, and it alters its tints with age. When it is young it is of a reddish colour; but when it has passed through a few months, it changes to dark olive-green, with whitish spots along the sides, and a white line along the back. In some specimens, the red hue shows itself upon the sides, so that the effect of the green, red, and white is very striking.

Though not possessed of brilliant hues, this butterfly is one of the prettiest British species. The upper surface is rich orange brown, spotted profusely with black. The most beautiful part of the colouring is, however, to be seen on the under surface of the hinder wings, which are olive, varied with brown, and decorated with spots that look exactly as if patches of silver leaf had been placed upon the wings and then burnished. The scales that form these metallic portions of the wing are exceedingly beautiful, and form very pretty objects for the microscope. The other species of this genus possess the silvery markings, some looking as if they had been hastily washed with silver, and others appearing as if the silver leaf had been laid on very thickly before it was burnished, so smooth and metallic is the aspect of these curious markings.

Perhaps it may be interesting to the reader to learn that, in a butterfly belonging to a different family, similar metallic patches are found, with the exception that, in this case, they appear to have been made of gold, and not of silver. In both cases, however, they occur on the lower surface of the hinder wings. This beautiful butterfly is rather small, rusty brown above, with several long and slender tails projecting from the wings; and, until the lower surface be shown, appears to be quite an ordinary insect. It is a native of Demerara.

The Adippe Butterfly is seldom seen in gardens, preferring woods and heaths, and is particularly fond of haunting the large open patches so often seen in forests, where the foxglove and the thistle rear their lofty heads, and afford it a temporary resting-place. It is a very local insect, for you may watch for hours together, and not see a single specimen, and yet, by moving to some favoured spot, not two hundred yards distant, you may take as many as you like. There is a little art required in capturing these broad-winged butterflies, which are apt to escape the stroke of the net, unless it be well delivered. I have always found that the surest plan is, to run the butterfly down, and strike so as to catch the insect from behind.

There is a group of common butterflies, possessing no brilliant tints, but prettily coloured with different shades of brown, pale yellow, and black, which are mostly seen in the fields, skipping along at a low elevation, rarely taking long flights, and generally alighting at every few yards. One of these creatures, the SPECKLED WOOD BUTTERFLY, or WOOD ARGUS, as it is sometimes called (*Hipparchia Ægeria*), is mostly to be found on the outskirts of woods, or flying, in its own uncertain manner, along the sunny side of hedge-rows. This butterfly may easily be known by the single black spot, centered with white, near the tips of the upper wings, and the curved row of four similar spots, edged with yellow buff, set round the edge of the hinder wings. There are several broods of this butterfly, occurring in the beginning of spring, in the middle of summer, and in the beginning of autumn.

The Wood Argus is a valuable butterfly, because its caterpillar feeds mostly upon the couch grass, that pest of the gardener, which drives its roots under the soil, starts up in places whence it appeared to have been thoroughly eradicated, and, if the least bit of a root be left in the ground, springs up again as green and as pert as ever. Perhaps some use may be found for this prolific plant; and, if so, the harvests will be plentiful, and the plant easily propagated. The caterpillar of this species is thickly and softly haired, of a greenish colour, and marked along the sides with streaks of yellow or white.

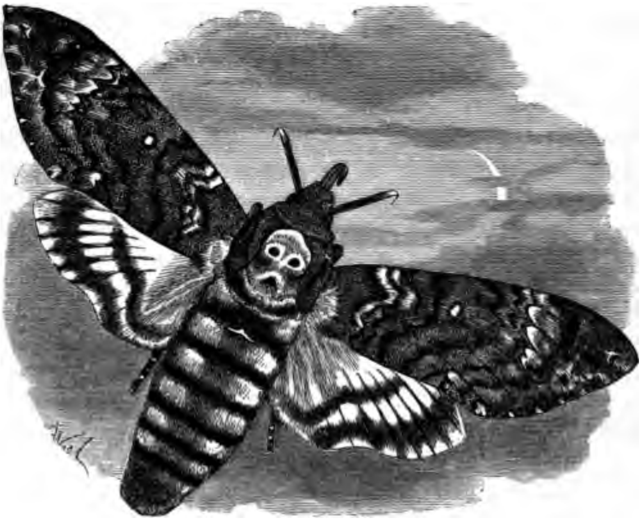
CHAPTER XXI.

MOTHS—Their Multitudes—Reasons for Selection—DEATH'S HEAD MOTH—Popular Superstitions—The Larva, its Appearance and Food—Alleged Depredations in the Beehives—BURNET MOTHS—Their remarkable Shape—and brilliant Colouring—Food of the Larva—The curious Cocoon—HUMMING-BIRD MOTH—Why so Called—Its Habits and rapid Flight—Its Larvæ and their Food—The CLEARWING MOTHS—Why so Named—Their Resemblance to other Insects—Their Agility on the Wing—Food of the Larvæ, and their Ravages in Gardens—EYED HAWK-MOTH—Formidable Aspect of its Larva—Sluggish Temperament of Caterpillars—Colours of the Insect—PRIVET HAWK-MOTH—The Caterpillar, its Shape, Colour, Food, and Development—Colour of the Perfect Insect—SWIFT MOTHS—Why so Called—Injurious Effects produced by the Caterpillar—Similitude between the Species—The GHOST MOTH—Ravages among the Hop Plant—Reasons for its Popular Name—Its curious Habits—Eggs of the Ghost Moth—The GOAT MOTH and the Injuries which it inflicts on Trees—Development of the Caterpillar—Its curious Structure—How to Destroy the Larva—Its noisome Odour—The WOOD LEOPARD MOTH—Beauty of its Colouring—Ravages of the Larva—Its Wooden Cocoon—Difference of the Sexes.

As to the MOTHS, and their caterpillars, their name is legion; and we must content ourselves with selecting some of the most prominent examples of useful or pernicious species, troubling ourselves not at all with the systematic arrangement of museums, but taking those that are most plentiful, and therefore most potent for good or evil.

The Hawk Moths, with one or two exceptions, have little influence upon the garden. There are, however, certain exceptions, which we must notice.

The largest of them all, the well-known DEATH'S-HEAD MOTH (*Acherontia Atropos*), has long been celebrated for the wonderfully close representation of a skull and part of the shoulder-bones that appear on the upper part of the thorax. It is also notable for producing a kind of small squeaking sound, when handled; and in consequence of these two properties, it has inspired the greatest dread among ignorant people. It is not nearly so rare an insect as is generally supposed; but, owing to its nocturnal habits, and the close concealment in which the caterpillar lives, it is not seen so often as might be presumed from its numbers. Even now-a-days, when the elements of most sciences are carried into every nook and corner of the land, we occasionally find a local journal devoting a paragraph to the wonderful fact that a Death's-Head Moth has been found in the neighbourhood. Moreover, the eyes shine at night like two globes of fire, as is often the case with the nocturnal moths, and therefore add much to the fear-inspiring powers of the creature.



DEATH'S-HEAD MOTH.

The larva of this insect feeds mostly on the potato and jessamine; and since the former plant has been so largely cultivated, the numbers of the moth have necessarily increased. Though they are seldom to be seen by day, being night-feeders, these caterpillars may be caught after dark, by the employment of a good bull's-eye lantern, and, with its aid, searching a potato-field. Those who engage in this pursuit will do well to provide themselves with a pair of stout leather gaiters; for the dew is always so heavy, that, but for some such precaution, the feet and legs, from the knee downwards, will in a short time be as wet as if they had been plunged into water. Those who are curious in such matters can readily breed the moths, the only certain method of obtaining perfect specimens.

Large as is this caterpillar, sometimes attaining a length of five inches, and being rather more than proportionately stout, it does but little harm to the potatoes, though its depredations must necessarily be extensive; but when it takes to the jessamine, that sweetest of garden plants, it becomes a nuisance, and must be treated accordingly. The jessamine will sometimes suffer in a rather singular manner, the leaves being stripped of their verdure, and no creature to be found on whom the blame may be laid. Snails and slugs usually have the credit of this damage, but the Death's-Head caterpillar may mostly be considered the destroyer. It may be detected in the night-time by means of a lantern, and caught in the very act of eating the leaves; and in the daytime may be captured by digging in the ground near the roots of the injured plant.

It is a great yellow caterpillar, ornamented along the sides with seven green bands, drawn obliquely as if by single sweeps of a camel's-hair brush. There are, besides, a great number of little blue and black spots along the back. On the upper part of the tail is a kind of horn. The moth is said to enter beehives, take up its residence there, and teed upon the honey. The bees are thought to be paralyzed, as it were, by the sharp squeaking cry that is uttered by the moth. How this sound is produced is not certain, and the whole story of its honey-seeking propensities has still to be corroborated before it can be received as a fact.

THERE is a small group of insects termed BURNET MOTHS, which are sufficiently injurious to vegetation to bring them within the scope of this work; while they present such remarkable peculiarities of structure that they would deserve a passing notice, even if they were to be ranked among the neutrals.

Most of my readers are aware that the chief popular distinction between the moths and the butterflies lies in the antennæ, those organs being pointed in the former section, and tipped with a club-like knob in the latter; yet in these insects, which undoubtedly belong to the moth tribes, the antennæ are knobbed at the tips, and, to an unaccustomed eye, are very like those of the butterflies. The insects are, moreover, day-flying creatures; so that they present two of the strongest characteristics of the butterflies, namely, the knobbed antennæ and the diurnal flight. It certainly is not much of a flight, the moths generally remaining rather near the ground, and resting after each short flight. But the moths do, at all events, display as much power of wing as is shown by several butterflies; and when alarmed, they can fly with very tolerable swiftness.

If, however, the reader will place one of these antennæ under the microscope, he will see that it does not in the least resemble the same organ in a butterfly, and that though it is smaller near the tip, it is not clubbed, and the extremity is really pointed. In the male insect, moreover, the thickened portion of the antenna is slightly notched like the teeth of a saw.

These insects feed on various grasses and leguminous plants, and in some places are extremely plentiful, flitting in great numbers over the ground. Their wings are very beautiful, the general hue of the upper pair being the darkest imaginable green, on which are set certain spots of deep crimson. These spots are extremely variable, sometimes being so large that they form a single fiery patch on each wing. The lower pair of wings are crimson, with a rich azure margin, broadest in the males. The body is of the same deep hue as the upper wings.

The caterpillar of this moth is rather pale yellow, with several rows of little black spots. When it has passed through its last moult, the caterpillar climbs up the stem of some plant, and there spins a shuttle-shaped cocoon, always placed perpendicularly, and fastened throughout its length to the upright stem. I have had many of the moths from the cocoon, and found that they suffered sadly from the ichneumon flies—insects which have so often destroyed my hopes of rearing perfect specimens for my cabinet.

About five species of Burnet Moths are known, all of which are to be recognised by the general shape, and the peculiar antennæ, which, as the reader may possibly have observed, bear some resemblance to those of the death's head moth. The species which is selected for the figure is that which is most plentiful in this country. It is called the SIX-SPOT BURNET MOTH (*Anthrocera filipendulæ*), because on each upper wing there are six crimson spots, arranged in pairs.

HUMMING-BIRD MOTH.

EVERY one who has cultivated flowers, or who is fond of watching the wild blossoms of the hedgerows, must have seen a rather large brown moth hovering about the flowers, and drinking their sweet juices, while poised on the wing. This is the HUMMING-BIRD MOTH (*Macroglossa stellatarum*), an insect which is very appropriately named, as its actions bear a wonderful resemblance to those of the bird from which it derives its popular name.

At one moment it will be seen suspended, as it were, in space, its wings scarcely visible from the rapidity of their vibrations, its body motionless as if fixed by wires, and its long tongue thrust into the depths of some flower. Suddenly it flashes off sideways, and in a moment is seen engaged upon another flower, though its movements are so quick that the transition is quite invisible. It will then dart through the air so quickly, that it looks much like a dark streak drawn rapidly, and then vanishing; and, perhaps, in another instant it will be again seen tranquilly poised above the flower which it had left. Generally the insect hovers above flowers; but I have seen it examining a long brick wall with the greatest attention, apparently inspecting all the crevices and going over every foot of surface. A hasty passenger, unfortunately, drove the moth away, and as it did not return, there was no opportunity of ascertaining its object.

The larva of this moth is possessed of far handsomer colours than those which fall to the lot of the perfect insect. The moth itself is only brown, black, and white; but the caterpillar is green, and is striped with brown, white, and yellow. It feeds upon various species of Galium, and several other plants.

NEARLY allied to the Burnet moths come the insects which are appropriately called CLEARWINGS, because the greater part of the wing is devoid of scales, and is as transparent as the membranous wing of a bee or a fly. They are further remarkable for the extraordinary resemblance which they bear to insects belonging to different orders, and have received their popular names in consequence of that similitude. There are, for example, Hornet Clearwings, Wasp Clearwings, Andrena Clearwings, Ant Clearwings, and Gnat Clearwings.

The common GNAT CLEARWING (*Trochilium vespiforme*) derives its name from its great resemblance to the insect whose name it bears. It is, indeed, so like the large gnats, that many persons cannot comprehend that it is a true moth. Pretty little beings as the Clearwings are, they rank among our worst foes; and if their numbers were more considerable than is the case, they would be scarcely less terrible than the wireworm or turnip-fly, and be the more injurious because their ravages are unseen.

In the summer months, the moth may often be seen reposing on the leaves of the currant, and, as it is rather sluggish in its movements, may easily be captured. When it is fairly on the wing, it is swift and agile as the insect from which it takes its name; but it seems to be so thoroughly absorbed by the gratification of receiving the hot sunbeams upon its body, that it is very unwilling to move unless a shadow be cast upon it. Although it is such a pretty little insect, with its transparent wings and the delicately contrasted tints of king's yellow and deep blue-black, it ought to be abolished whenever seen. The larva of this small but mischievous moth bores into the young twigs of the currant, and feeds on the pith, where it lies concealed until it emerges into the world in its perfect state.

CLEARWING MOTHS.

The colour of the larva is yellowish white, with the exception of a dark line along the back, and the brown hue of its head and feet.

The LUNAR HORNET CLEARWING (*Sphecia bembeciformis*) is not nearly so common as the preceding species. The larva feeds upon the willow and osier, sometimes working much damage to those valuable plants. The perfect insect is generally captured upon the leaves of the osier; but to take it is not a very easy task, as it is very wary, and on the least alarm drops to the ground. As is the case when attempting to capture all insects which have a similar instinct, the best method of securing this handsome moth is by slipping the net very gently below it, and then striking smartly upwards. While sitting on the leaves, enjoying the sunbeams, the insect has a very wasp-like habit of raising and lowering the abdomen.

The colour of this moth is marvellously like that of the hornet, yellow and deep red being the two principal tints. The larva is nearly white, as is generally the case with those larvæ which live in the dark, and, like the preceding species, it resides in the interior of the branches, feeding upon the pith. The caterpillar undergoes all its changes within the stem of the tree. This is a rather large species, the expanded wings measuring about an inch and three-quarters from tip to tip.

THE beautiful insect which is called the EYED HAWK-MOTH (*Smerinthus ocellatus*), is one of a group which are occasionally very destructive to gardens, though they mostly prefer to reside in the fields and woods.

This is a large and broad-winged moth, measuring more than three inches across the wings, and having a stout, plump abdomen. A very large caterpillar is required from which can be formed a moth of such dimensions; and, in fact, the larvæ of this group are often so large, and have so formidable an aspect, that many persons are afraid of them, and will not venture to touch them. They are as long and as thick as a man's finger; they are furnished with a sharp curved horn upon the tail, which is never employed in attack or defence, and the use of which no one knows.

Indeed, a caterpillar seems to be totally devoid of the combative principle. It has not the least idea of fighting, in spite of its powerful jaws. If you catch it, the creature will twist and writhe about in its endeavours to escape, and if you put your finger to its mouth, it will instinctively open and close the mandibles, so as to inflict a smart bite; but of fighting, strictly so called, it has no conception, and seems to be incapable of entertaining the passion of anger. All larvæ are not so mild in their disposition; for that of the great water-beetle is a fierce and determined being, using its large curved jaws with great effect. As, however, this larva is predaceous, its actions cannot be considered as analogous to those of the vegetable-feeding caterpillar. I have certainly read of one exotic caterpillar which has been known to bite fiercely the hand which holds it; but I cannot concede that this action is entitled to be considered as a combative movement, or that the creature has any notion that its jaws can inflict injury upon the captor. That its powerful mandibles will close firmly upon any object with which they come in contact is likely enough, but the movement is one of pure instinct, and not prompted by reason.

The colour of this caterpillar is green, with a little yellow round the head, pinkish circles round the spiracles, and eight oblique white bars upon the sides. It is mostly found upon the willow, but not unfrequently the mother insect lays her eggs upon the apple, peach, and almond; and when that is the case, the large, voracious, sharp-jawed larva works considerable damage to the trees. The upper surface of the fore wings is ashen grey, variegated with rich brown, and traversed by dark waving bands. The hinder wings are soft rosy pink, changing to yellow on the edges, and having near the base a large black patch, in the middle of which is an eye-like mark.

OUR next example of this group of insects is the magnificent PRIVET HAWK-MOTH (*Sphinx Ligustri*), one of the largest British moths; a fine specimen measuring nearly five inches across the wings.

The caterpillar of this moth is extremely large, and, as may be conjectured from the popular name of the insect, feeds upon the privet. It is not, however, restricted to this shrub, but is found upon the lilac, elder, and other garden trees, consuming vast quantities of their foliage, as any one will find who desires to rear it at home, and is obliged to take upon himself the task of supplying it with food. It is a remarkably beautiful caterpillar, being light green, with a black patch on each side of the head, orange bands round the spiracles, and seven oblique streaks of purple and white along the sides.

The young and full-grown caterpillar are so unlike each other, that they might easily be taken for different species. During its first few moultings it is covered with bold wrinkles, but after the last moult the body becomes quite smooth and is suffused with red. It then burrows to some depth into the ground, where it lies until its final change, when the chrysalis makes its way to the surface of the soil, bursts, and permits the beautiful moth to escape. If it be kept above ground, so as to permit its changes to be seen, it first seems to wither away, and becomes wrinkled, soft, and flabby, and to an inexperienced eye appears to be dead. Presently, however, the skin opens, and the inclosed chrysalis shows itself. The creature remains in this state for a varied length of time—sometimes for seven months, and sometimes for two or even three years.

This moth has a long proboscis, which is inclosed in a kind of hollow horn projecting from the head of the chrysalis. In some species this horn is enormously long; as, for example, in the Convolvolus Hawk-moth, where it is bent over upon the chrysalis case, just like the handle of a jug.

The colour of the Privet Moth is very handsome. The fore wings are ashen grey, with a rosy tint at the base, a very delicate white line along the edge, and many patches and waved lines of brown. The hind wings are light rose-pink, crossed with three bold black-brown belts, narrow towards the inner and broad towards the outer edge. These wings take a slight yellowish tinge towards the edges, and are fringed with greyish white. The abdomen is of the same rose-pink as the wings, and is crossed by several broad black belts, broken in the middle by a bar of ashen grey, which runs along the centre of the abdomen. The tip is black.

This insect is much more plentiful in England than is generally supposed, its nocturnal habits withdrawing it from view. The caterpillars may easily be found, as under the part of the tree on which they are feeding may be seen a number of rather conspicuous green pellets, which are the undigested portions of the leaves on which the creature feeds. The caterpillars, by the way, live in reality only on the liquid juices of the plants, inasmuch as the refuse portions, when placed in warm water and spread out, are found to be nearly unchanged in appearance, even retaining the green colouring matter, and showing it, under the microscope, to be scarcely disturbed by the processes of mastication and digestion.

THE two insects which we are now about to describe, belong to that group which has obtained the popular and appropriate name of Swift Moths, the flight of these insects being straight and remarkably rapid; so rapid indeed, and so direct, that the best method of catching them is to meet them in their flight, and strike the net directly against them. A side stroke, such as is sufficient for most butterflies, is almost ineffectual against the Swifts, and they fly so quickly, that to overtake them is almost impossible.

The SMALL SWIFT (*Hepialus lupulinus*) is a very soberly coloured insect, being dark tawny brown in the male, and paler in the female, with some greyish white lines just inside the edges of the wings, and a short longitudinal streak at their bases. As is usual with most insects, the male is smaller and darker-coloured than its mate. The colours of this insect are, however, extremely variable, both in their arrangement and intensity, and often in their very hue, some specimens being of an uniform pale grey-brown, without any streaks or mottlings whatever.

All the Swifts are injurious to vegetation, the caterpillars feeding on the roots of plants, and, in consequence, being very seldom seen above the surface of the ground. Grasses are very liable to the attacks of this creature, which should always be destroyed when found. Indeed, it may safely be assumed that every subterraneous larva found in a garden is obnoxious to some plant, and that it ought, therefore, to be destroyed.

The perfect insect is very seldom seen in the garden, preferring hedgerows, especially those which are planted upon a bank. Towards evening the Swifts may be seen darting along with wonderful rapidity, their rapid flight and sober colours rendering them almost invisible in the twilight. They do not display much agility in changing their course, and I have captured many specimens by merely sweeping the net at random about eighteen inches above the bank, so that the insects flew into it of their own accord. In all the Swifts there is considerable variation of colour, so that to distinguish the species is a matter of much difficulty. The best plan for the amateur entomologist is first to ticket all the specimens which exhibit the distinguishing marks of the species, and to lay by for future examination those about which there is any doubt. The best book which any one can consult upon this subject, is, in my opinion, that beautiful work called " British Moths and their Transformations," by H. N. Humphreys and J. O. Westwood.

THE second species of Swift which I have selected for illustration is the GHOST SWIFT (*Hepialus Humuli*), an insect which is extremely injurious to the hop-plant, and therefore to be condemned by those who like to see this graceful creeper twined round their uprights and trellis-works. The larva feeds upon the root, burying itself in the earth, and there lying until it is changed into the perfect state. The colour of the caterpillar is pale dusky yellow, and it is furnished with successive belts of short, sharp hairs.

The name of Ghost Moth has been given to this insect on account of the curious habits of the male. In this sex, the upper surface of the wings is pure glittering white, as if made of frosted silver, and is peculiarly adapted to reflect every ray of light. The under sides of the wings are dark smoke-brown. The female is so unlike her mate, that few would imagine the two insects to be but the different sexes of the same species, her dimensions being larger, and her wings of a tawny yellow, banded and spotted with brown.

In the eventide, the male goes forth, like Romeo, to seek his bride, and finds her reposing at the foot of the grass-blades. In the dim light she is undistinguishable to human gaze, but the Ghost Moth sees her, and hovers over her in the strangest fashion.

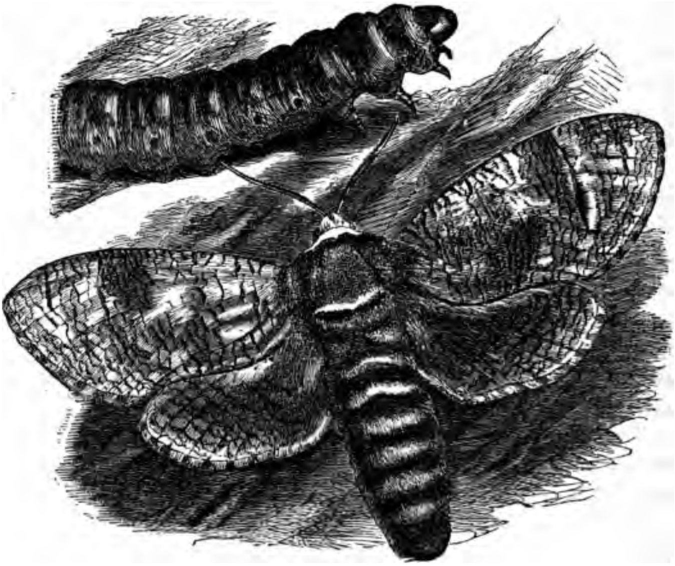
Sometimes he remains perfectly still, not moving an inch from his position, and sometimes he sways from side to side with a movement as regular as that of a pendulum. Churchyards are favourite resorts of this moth, which in consequence is often held in considerable terror by ignorant rustics, who fully believe that the white object swaying to and fro in so mysterious a manner, magnified much by the darkness, and more by their fears, is some supernatural appearance, and would not, for any bribe, venture to approach so fearful a being.

As if to add to the spectral effect of its peculiar flight, the moth occasionally vanishes for a minute or two, and then reappears in the same spot, not flying away and returning, but disappearing as suddenly as an extinguished lamp, and reappearing as mysteriously as it vanished. This effect is produced by the creature settling upon the plant over which it was hovering, and clinging to it, so that the shining surface of the upper wing faces towards the ground, and its reflections consequently become invisible. Probably in consequence of its conspicuous whiteness, the male Ghost Moth is eaten by various nocturnal wanderers, such as bats and goatsuckers, and its white glittering wings can often be found upon the grass over which the insect was hovering when it was captured by its destroyer.

The eggs of this moth are very minute, and of a jetty blackness, strongly reminding the observer of fine gunpowder. As if to add to the resemblance, they are not laid quietly, but are projected with a sudden violence, that has something almost ludicrous about it.

This moth is always a trouble to the collector. It is so very liable to "grease," that a really perfect specimen is seldom seen unless it be newly taken. I know but one method of preserving it from this pest of the cabinet, but the process would require so much space, that it cannot be described in this work.

The well-known Goat-Moth (*Cossus ligniperda*) may be ranked among the deadliest foes to the gardener, because it destroys the living wood of trees, making deep burrows with large openings, so that the rain can enter them, trickle into the very heart of the tree, and cause the whole of the wood to rot away.



GOAT-MOTH AND LARVA.

The perfect insect is a large, round-winged, brown-coloured moth, in no way conspicuous, and scarcely to be seen, in spite of its large dimensions, as it sits motionless upon the branches. The female lays a great number of eggs in the crevices of the bark, and during the first months of their existence, the young caterpillars live between the bark and the wood. When they have attained sufficient strength of jaw, they turn their attention to the wood, and bore their way into its substance. Here they remain for three years, becoming torpid every winter, and returning to activity as soon as the spring has set in, and eating long tunnels in the very heart of the tree, the burrows necessarily enlarging together with the rapid growth of the creature which makes them.

If the reader will take the trouble to dissect the next Goat-moth caterpillar which he finds, he will see that just within the part of the larva which we may call the neck, for want of a better name, are two large membranous sacs, partially filled with a liquid. From these sacs two delicate ducts proceed towards the mouth, and it is conjectured that the liquid contained within them has the property of dissolving the wood on which the creature feeds, and rendering it more easy of mastication or digestion.

The whole anatomy of this larva is very interesting, and, on account of its large dimensions, the caterpillar forms an excellent subject for those who desire to study this beautiful branch of science. The only difficulty is to be found in the enormous quantity of fatty matter; but when that substance has been removed, the wonderful arrangement of muscles, the delicate double line of nerves and their connecting ganglia, the huge digestive organs, the curious neck sacs, and the elaborate system of breathing tubes, can be exhibited in a very perfect manner.

The colour of this larva is lurid red above, with a high and rather peculiar polish. The remainder of the body is yellowish, and it has altogether a very repulsive aspect. As if to make it more disgusting, it exhales a most horrible scent, not unlike the powerful rank odour of the he-goat, and has, on that account, obtained the name of Goat-caterpillar. In some parts of England these larvæ are appropriately called Auger-worms.

To destroy these creatures is a very difficult task, on account of the extent and complicity of their burrows. Each tunnel that is discovered ought to be probed with a flexible wire, in hope of wounding the larva within, and I fancy that some strong ammonia, if injected smartly with a syringe, might destroy even the tough-skinned Goat-moth caterpillar.

When the larva has lived out its full time, it changes into a chrysalis, having first taken the precaution to place itself near an opening into the outer air. Just before the inclosed moth is ready to emerge, the chrysalis is pushed onwards, so that it partially projects from the aperture, and permits the moth to emerge unhurt into the world. The empty case of the chrysalis is left still sticking in the tree, and many of them may generally be found about June and July, in which months the moth emerges.

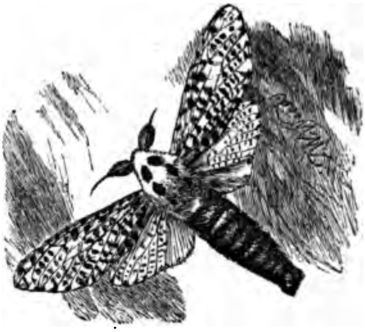
The caterpillar of the Goat-moth is found in several trees, and sometimes makes great devastations among the fruit-trees. The ash, elm, poplar, and willow, are also attacked by it, the last-mentioned tree seeming to be quite a favourite, and is sometimes so severely injured that a rather higher wind than usual will blow it down. Near my house there are several willow-trees that have been quite riddled by the Goat-moth caterpillar.

The strength of this larva is enormous. When held in the hand, it struggles with so much violence that its retention is a matter of some difficulty; it will push its way from under a tolerably heavy basin, its head being wedge-shaped and admirably adapted for that purpose, and if it be inclosed in a wooden box, it speedily bites a hole in it, and releases itself from its prison.

THERE is another tree-boring caterpillar which often does much damage, though it is not so large, nor so plentiful as the last-mentioned species. This is the larva of the **WOOD LEOPARD-MOTH** (*Zeuzera æsculi*).

Although the colours of this moth are remarkable for their simplicity, being nothing more than black and white, there are few more beautiful moths in this country. The ground colour of the wings and body is pure snowy white, covered profusely with spots of the deepest blue-black. The thorax is decorated with a double row of large black patches, and the abdomen is crossed by several bands of the same deep hue. In size it is rather variable, the expanse of wing varying from two to three inches.

The larva is tolerably plentiful, but the moth is not so often seen, probably because its miniver-like plumage renders it so conspicuous, that the little birds are enabled to discover and eat it almost as soon as it has emerged from the trunk of the tree in which it has lived, and before it is able to use its wings properly. Almost every tree is suitable to this insect, except perhaps the oak, the box, and other hard-wood trees. In gardens it is injurious to the pear, apple, walnut, hazel and chestnut, and in the open country does some damage to the elm, ash, beech, birch, and other forest-trees.



WOOD LEOPARD-MOTH.

The larva of this moth has some slight resemblance to the perfect insect, being pale yellow, spotted profusely, and rather equally, with black. There is a patch of deep chestnut-red at each extremity of the body. When it is about to enter into the chrysalis state, it makes a cocoon of chips of wood agglutinated together, so as to form a rather strong case, in which it can reside in safety during its period of helplessness. The same habit is to be noticed in the caterpillar of the Goat-moth.

The male of the Wood Leopard-moth is barely half the size of the female, the wings take a yellower tinge, and the spots and bars are paler, and take a bluer tint. He can always be distinguished from his mate, not only by his dimensions and colour, both of which are rather variable, but by the shape of the antennæ, which are richly feathered for the basal half of their length, whereas those of the female are nearly simple.

CHAPTER XXII.

BUFF-TIP MOTH—Its Form and Colour—The Larva and its destructive Habits - The FIGURE OF 8 MOTH—Its Colour and Shape—Injuries Worked by the Larva—Colour of the Caterpillar—EMPEROR MOTH—Beautiful Markings of the Caterpillar, and its Food—Its wonderful Cocoons—Analogies of Nature—Escape of the Perfect Insect—Colour of the Moth—LACKEY MOTH—Why so called—Its Eggs and the Mode of their Deposition—Destructiveness of the Caterpillar—Modes of Destroying the Larva—Injuries Wrought by the Insect—Description of the Perfect Insect—LAPPET MOTH—Why so called—Form and Colour of the Larva—Its Voracity and the Plants on which it Feeds—Colours of the Moth—Attitudes of Insects—GOLD-TAILED MOTH—Its Description—Its Eggs and Mode of Sheltering them—Habitation Spun by the Insects—The Larva and its Colour—Methods of Destroying the Caterpillars—The TIGER-MOTH and WOOLLY BEAR—Colour of the Insect—Description of the Larva, its Food—Habits of the Moth—Freedom from Ichneumons—ANTLER MOTH—Its Periodical Appearance, and vast Numbers—Ravages of the Larva and its curious Habits—Colour of the Moth—The POT-HERB MOTH and its Names—Herbs eaten by the Larva—How to Find and Kill the Caterpillar—Description of the Moth—The CABBAGE MOTH—Food of the Larva—Habits of the Caterpillar—Moth-Hunting—How to "sugar" for Moths—The DOT MOTH—Description of the Moth and Caterpillar—Colour and Habits of the Larva—The BROWN MOTH and its Colours—Destructive Habits of the Larva.

OUR next example of the insect foes is the curious BUFF-TIP MOTH (*Phalera bucephala*), so called because the tips of the wings are marked with a conspicuous spot of buff.

The form of the moth is very peculiar, and whether its wings be expanded or closed, it is at once recognisable, even at a hasty glance. It has a peculiarly unique aspect when the wings are closed. They are laid along the body, and as the thorax is adorned with two feathery tufts, and the head is bent rather downwards, it is scarcely visible, and, but for the antennæ, it existence would hardly be suspected. The tufted thorax, with its abrupt front, gives to the insect an appearance which fully justifies its specific name of *bucephala*, or bull-headed.

The caterpillar of the Buff-tip Moth is terribly destructive. It is one of the social species, and may be found in very great numbers upon different trees, remaining in society while it is young and small, but separating when it approaches its full growth, and needs more nutriment. Thirty or forty individuals are often found forming one party, and other bodies are sure to be near at hand. These larvæ are generally to be seen about the months of August and September, and can then be destroyed without difficulty, on account of their social habits.

The colour of the caterpillar is yellow, with a number of rows of short black stripes. The width of these streaks is sometimes variable, but in some specimens they are so wide, that the caterpillar appears to be black, adorned with yellow streaks. When it has attained its full larval growth, it descends to the ground for the purpose of burrowing under the earth, where it passes through its last stages of development, emerging in the springtide of the succeeding year. Towards August, the caterpillars may be seen in all directions, crawling over the ground in search of a soft spot wherein they may burrow, and none thus seen should be permitted to escape.

The colour of the moth is silvery grey above, mottled with chestnut, and streaked and spotted with black. At the tip of the upper pair of wings, there is a large oval spot of buff-yellow, and the hinder pair are simple whitish grey. In size it is very variable, some specimens measuring two, and others three inches, in expanse of wing. The antennæ of the male insect are thick and rather bluntly toothed, and furnished, as far as their tips, with a double row of bristles.

Various trees are devastated by this caterpillar, such as the elm and the much suffering oak, which really seems to afford food to half the British insects. To the gardener, however, it is especially obnoxious, because it is very fond of the filbert-leaves, clustering upon them in great quantities.

THE common FIGURE OF 8 MOTH (*Diloba* [*or Episema*] *cæruleocephala*) may at once be recognised by the peculiarity from which it derives its name.

The colour of the upper wings is bluish grey, slightly mottled with brown, and having in their centres a double pair of dark spots, surrounded with white, and so arranged that they look exactly like the figures 88. These spots have happily been compared to a couple of kidneys, cut open and displayed on a plate after being broiled.

This moth should always be destroyed when found, as its larvæ are extremely injurious to our gardens, feeding upon the young and tender leaves of the plum, peach, apricot, and other trees producing stone fruit. When the parent moth does not lay her eggs upon garden trees, she chooses those which are analogous to the plums of our garden, and so deposits her eggs upon the sloe-tree, so plentiful in the hedges.

The caterpillar is rather prettily coloured, the ground tint being lead-colour, variegated with round black spots, and there is a yellow line, edged with black, drawn along the side.

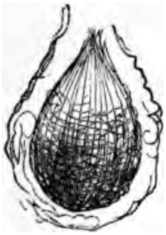
OUR next example of the garden foes is a very beautiful insect, both in the larval and perfect states, and it is so interesting in some of its habits, that were it as ugly as it is handsome, it would equally attract attention.

The EMPEROR MOTH (*Saturnia Pavonia minor*) is very plentiful in some parts of England. The caterpillar may immediately be recognised by its remarkable shape and brilliant colours.

The rings on the body are deeply marked, as if cut with a lathe, and each ring is surrounded with a belt of raised gold-coloured spots, from which proceeds a little tuft of bristles. The general colour of the caterpillar is bright green banded with black. When touched, it rolls itself up into a spiral form, and then displays the beautiful gold-coloured spots to great advantage. This caterpillar may be found upon apple-trees, and is somewhat destructive to them, though its numbers are not so formidable as those of many other smaller insects.

The chief interest of this insect lies in the wonderful cocoon which it spins just before it makes its change into the perfect condition.

If one of these curious structures be taken into the hands, and merely subjected to a casual examination, it will not appear to possess any particular claims to attention, being apparently nothing more than a simple flask-shaped cell, rather stiff, and surrounded with a covering of loosely-woven silken threads, something like those which appear on the exterior of the cocoon spun by the silkworm. But if that outer covering be stripped away, a second cocoon will be discovered, formed on a plan equally admirable for its efficacy and its simplicity.


COCOON OF EMPEROR MOTH.

The outer covering, or outer cocoon as we may call it, is merely composed of loosely twisted fibres; but the inner cell is made of strong hair-like threads, the ends of which converge towards the narrow end of the cocoon, and are pressed against each other by their own elasticity. The accompanying illustration is a kind of plan of this cocoon, showing the manner in which the double cocoon is formed. It will be seen, by reference to the engraving, that any creature within the cocoon can emerge with the greatest ease, the converging threads separating to permit its passage, and closing by their elasticity when it has made its escape. But, even for the former inmate to re-enter the cocoon would be an evident impossibility, the stiff threads which close the entrance only permitting exit.

I may here remark that an analogous structure may be seen in the valves of the heart and the veins, with the exception, that as a liquid, and not a living creature, is to be permitted to advance in one direction, while it is strictly debarred from moving in another, the apparatus is formed not of threads, but of membranes. In the throat of the crocodile there is a similar structure, which permits the creature to breathe, while it effectually prevents the water from running down its throat.

If the reader can manage to procure several of these wonderful cocoons, he ought to place at least three of them in his cabinet; one entire and uninjured, another with the outer covering removed, and a third laid open, so as to show the chrysalis lying comfortably in its self-made cradle, and the beautiful arrangement by which the moth is able to make its escape.

In almost all other cocoons, the passage of the perfect insect either destroys the cocoon entirely, or very much mars the perfection of its form; but when the Emperor Moth has passed into the world, it leaves no trace of its progress, the elastic hairs which close the entrance of the cocoon returning as soon as the creature has passed between them.

The whole structure of this cocoon may be compared to that of a common lobster-pot or crab-creel, into which the animals can enter easily enough, but out of which they cannot by any means escape. The well-known wire mousetrap, immortalized by Sir Joshua Reynolds in his celebrated "Muscicapa," is another example of this structure applied to human uses.

The colour of the Emperor Moth is very handsome, but so complicated as not to be easily described. Perhaps the simplest plan will be to borrow the accurate, though rather technical description of Mr. H. N. Humphreys: "This species varies from two and a half to three and a half inches in the expansion of its fore wings, which in the males are of a grey-brown, but paler in the females. A pale oblique bar, bordered on each side with black, runs across near the base, succeeded in the centre by a pale oblong patch, within which is a beautiful black eye-like mark, inclosing a yellow ring, with a slender pale-blue crescent. This is succeeded by a wavy fulvous (*i.e.* tawny) stripe edged with black, and terminating in a black patch on the costa, beneath which is a white and red blotch, the margin of the ring being pale grey-brown, separated from the disc of the wing by a white submarginal streak. The hind wings are bright fulvous in the male, but grey in the female, with an ocellus in the centre, similar to that of the fore wings, succeeded by a slender dark wavy line, then a pale wavy bar, and a broad dark bar, the outer margin being dark coloured, but separated from the disc of the wing by a white streak."

Besides feeding on the apple, the caterpillar of the Emperor Moth devours the leaves of the willow, and even the heather.

Our next example of the insect pests is not conspicuous either in the larval, pupal, or perfect stages of its development, and if we are to look for any point of interest in its manner of life, we must refer to its eggs. Upon hedges, upon fruit-trees, and indeed upon almost any kind of tree or shrub may be seen, in the winter time, curious little "bracelets" of round eggs, all fastened so firmly together that they can be removed in one piece. These are the eggs of the Tree Lackey Moth (*Clisiocampa neustria*), so called in contradistinction to an allied species, the ground lackey moth, the larva of which is not at all mischievous in our gardens, feeding upon low growing plants by the sea-shore.

The mother moth proceeds to her work in the autumn, and deposits round the twigs of trees, row upon row of the eggs, fastening them together, and covering them with a waterproof cement or lacquer, that serves to defend them from the snows of winter. The name Lacquey Moth is evidently a corruption of the word Lacquer. If the eggs be examined with a microscope, it will be seen that the pressure has quite altered their form, giving them a shape more or less hexagonal. There are from ten to eighteen rows of these eggs, according to the size of the twig on which they are placed, and on a closer inspection they will be seen to be arranged in a beautifully regular spiral.

These bracelets are very pretty objects, but should be ruthlessly crushed wherever seen—a duty that can be accomplished by the pressure of the knife-haft. In April or May these eggs are hatched, and from them proceed a number of very little caterpillars, which at first are scarcely visible from their minuteness, but rapidly increase in size. When they have attained moderate dimensions they are very pretty little creatures, striped with blue, red, yellow, and white, and are found in vast numbers. They are social in their habits, spinning a common web, and residing thereon, the threads serving them as ladders whereby they can proceed from one part of the tree to another. During the day-time they are scattered over the tree on which they live, always drawing after them a thread on which they can return to the nest at will. In the night-time, or during rainy weather, the caterpillars cluster together in their nests, which are spun in the forks of the branches, so that the gardener can make short work of them by visiting the trees by night, or during a shower, and removing the nest entire.

Or, if the ground beneath the branches be level, the whole tree can sometimes be cleared by laying sheets carefully under it, and then striking the boughs smartly with a long stick. Down come the caterpillars all in a hurry, each suspended by its thread, and are received in the sheets, whence they can be picked, and either killed by being thrown into the ammoniated solution already mentioned, or can be handed over to the poultry, which will in a very short time gobble up the caterpillars in spite of their activity.

Fruit trees are especially liable to the attacks of these caterpillars, which are sometimes found in such amazing numbers that whole trees are stripped of their leaves, and rendered ghostly or unsightly objects, their twigs standing out bare and naked against the sky, and their branches disfigured by the heavy masses of web and caterpillars which hang like wet rags upon them. If the trees have been neglected, and the caterpillars have been allowed to attain their full growth, the only method of checking the ravages of a future brood is to search for the cocoons, which may be found in abundance on the trees, in hedges, and on neighbouring walls.

The moth, though so plentiful, is not very often seen, its dull colour and nocturnal habits rendering it very inconspicuous. Its colour is rather variable, but always has much yellow in it, and sometimes is warmed by a little red. Across the upper pair of wings runs a dark band, bounded on each side by a lighter line. The male is darker than the female, and the body is much more slight. The colours and their intensity are always variable, but the sexes can be distinguished by the antennæ, which are deeply fringed in the male and simple in the female.

LAPPET MOTH.

Although it is scarcely to be called a common insect, the larva of the Lappet Moth (*Gastropacha Quercifolia*) is in some places very plentiful, doing much damage to the pear and willow trees. The whitethorn is also subject to its ravages, and several grasses serve it for food.

The name of Lappet belongs by right not to the moth, but to the caterpillar, which is so named on account of the fleshy appendages or lappets along its sides. It is a very large caterpillar, dark grey or brown in colour, and is notable for two rather wide dark blue stripes near the head. A number of bunches of hairs are also seen along the body, that upon the last segment but one being the most conspicuous. I have reared many specimens of this fine caterpillar, which I used to find plentifully among the whitethorn in a hedge near Oxford. It is very voracious, and, unless taken just before its transformation, gives much trouble to its owner, who finds the task of supplying it with food a very laborious one.

When it is about to change into a chrysalis, it spins a curious spindle-shaped cocoon, which is almost always larger at one end than at the other. The colour of the cocoon is brown, and its texture is rather soft and flimsy, being loosely spun, and the interstices filled with a powdery substance, with which the chrysalis is generally covered.

The perfect insect is a really curious creature. Its colour is dark brown, taking a chestnut hue towards the base of the wings, and the body is of the same sober colour. The edges of the wings are deeply toothed; and when the moth is in a state of repose, the wings are arranged in the remarkable position shown in the illustration, so that the insect looks exactly like a bunch of withered leaves, and would evade the glance of any but an experienced eye.

The collector of insects should be careful not to "set" all his prizes in the same manner. He should watch their habits, and arrange their wings as they are placed by the living creature. And as the attitudes assumed during repose are always exceedingly characteristic, he should invariably place one specimen in the cabinet so as to show its natural attitude when at rest.

ALL persons accustomed to walk in the garden must have noticed a beautiful white moth, covered with soft downy hairs, and having a wide tuft of gold-coloured plumes at the end of its tail. This is the GOLD-TAILED MOTH (*Euproctis* [or *Porthesia*] *Chrysorhœa*), the larva of which is sometimes extremely destructive.

The moth is often to be found sticking on the trunks of trees, its white feathers contrasting beautifully with the deep brown of the bark.

The mother-moth lays about three hundred eggs, and when she has deposited them she covers them with the short golden-coloured hairs which grow at the end of the abdomen, and which she plucks off for the purpose, denuding herself of this ornament for the sake of her future young, just as the rabbit strips herself of her down for a similar purpose. This covering acts as a roof for the eggs, and defends them from cold and wet.

As soon as the caterpillars are hatched they betake themselves to the nearest leaf, and therein they spin a curious kind of habitation, consisting of numerous threads drawn from one edge to the other, so as to form a roof under which the little creatures can reside. In a few days they become large enough to make a more roomy domicile, and speedily construct their enlarged house by selecting some branching spray, and surrounding the twigs with their threads until they enclose a considerable space.

This habitation has no particular shape, but is formed according to the number and position of the twigs, and is necessarily angular in its external form. The caterpillars are continually adding to the thickness of their walls, so that in process of time the habitation becomes very stout, and is able to resist rain. The caterpillars are very impatient of wet, and, like those of the lackey moth, invariably retreat to their nest when rain begins to fall. They repair to the same stronghold at night, and when they wish to change their skins.

At the first breath of winter they retire to their silken home, and there they remain in a state of torpidity, until spring brings forth the leaves and summons the caterpillars to the resumption of their interrupted banquet.

The caterpillar of the Gold-tailed Moth is rather pretty, being dusky brown, relieved by two red stripes along the back, a white band along each side, and some whitish tufts along the sides. In some seasons these larvæ appear in vast numbers, and strip whole trees of their foliage. They have been so plentiful in certain localities, that when a reward has been offered for them, they were gathered in bushels-full from the trees. It is a rather curious fact, that when the caterpillars desert their nest, as is the case when they have reached their full growth, the spiders take possession of it, and are thought by many persons to be either the parents or offspring of the caterpillars.

The colour of the perfect insect is white in both sexes, and the male may be distinguished by his smaller dimensions, the absence of the large gold-coloured tuft at the end of the abdomen, and the deeply-feathered antennæ. It is not a large moth, the expanse of wing never reaching two inches, and being on an average an inch and a half.

EVERYONE knows the Woolly Bear, the great long-haired caterpillar that is so often seen crawling hurriedly over our paths, that curls itself into a ring as soon as touched, and that is so difficult to hold when picked up in the fingers, its long hairs causing it to slip out of the grasp as if it had been oiled. This curious creature is the larva of one of our handsomest moths, a species which, if it were as rare as it is plentiful, would have been the glory of the cabinet in which it held a place. All the members of this genus and its allies are singularly beautiful creatures, but there is none that equals the splendid TIGER MOTH (*Arctia caja*), with its glowing scarlet, rich brown, creamy white, and the deepest blue-black.

The whole "composition" of these colours, as a painter would call it, is singularly harmonious; and though the tints are so violently opposed to each other, they are arranged in such a manner that neither seems to be obtrusive. How thankful we ought to be that the handsomest insects are in this land the commonest, and that those who love beauty for its own sake, and that of its Creator, can be gratified without cost! The colours of the Tiger Moth are always variable, but are generally as follows:—The fore wings are rich brown, marked with many large and irregular spots of cream white; and the hinder wings are bright scarlet, spotted with black, over which plays a gloss of blue in certain lights. Even the body is gorgeously decorated, the brown thorax having a bright scarlet band, and the abdomen being scarlet, barred with the same blue-black as that on the wings. It is stated by Dr. Geer that, when the scarlet neck-collar is touched, some drops of a translucent liquid filter out among the hairs; but I never saw this phenomenon, and do not therefore personally vouch for it.

The "Woolly Bear" feeds on several garden plants, especially the lettuces and strawberries, and is apt to do much damage among them. It should therefore be ruthlessly extirpated when found in the garden. In the fields it does little, if any harm, feeding chiefly upon the white dead nettle, and being generally visible about the eventide. I always shall have an affection for this insect, because it formed my first introduction to that most charming study, the comparative anatomy of insects. In order to be enabled to study the creatures at my ease, I had at one time several hundred specimens of the Woolly Bear, all in different stages of development, from the egg to the perfect insect. Dead nettles were fortunately near at hand, but the hungry creatures used to finish a large armful daily.

The moth, although so plentiful, is not very often seen on the wing, preferring to run about the ground among the herbage, a feat which it performs with great agility, being furnished with very active limbs. While so occupied, the wings are laid along the back so as nearly to conceal the whole of the scarlet colour; and as the insect runs brisky to and fro, and traverses the flower-beds, the active brown object might readily be mistaken for a small mouse. I have more than once committed that error, and have seen a kitten fall into the same mistake. In some specimens, the cream colour overspreads the whole of the front wings, that brown only existing in small detached patches; while in others, the whole of the moth is brown, that tint having swallowed up the creamy white, the scarlet, and the black. These varieties are not, however, of common occurrence.

I have dissected hundreds of the caterpillars, and find that they do not appear to be so subject to the ichneumon-flies as is the case with many larvæ, probably because the long hairs keep those insidious foes at a distance, and prevent them from using their fatal ovipositors. The name *Arctia* is derived from a Greek word signifying a bear, and is very appropriately given to this genus of insects. By the Scotch it is known by the name of the "hairy ourbit." As is the case with many of these moths, the male is smaller than the female, and can be distinguished by the more feathery shape of his antennæ. The expanse of wing is about three inches.

THE insignificant-looking insect called the ANTLER MOTH (*Cerapteryx graminis*) is one of those curious beings which appear at distant and uncertain intervals, suddenly covering the land with their multitudes when they do make their appearance, and vanishing as suddenly and unexpectedly as they came.

Those observers who have recorded its presence have always remarked, the vast armies which assemble over certain spaces of ground, patches measuring a mile square having been devoured by them as effectually as if a fire had swept over the land. The line of demarcation within which these strange beings confine themselves is so strongly marked, that even from a considerable distance the spot which they have selected and devastated can be distinguished from the surrounding.

Optimists have not been slow in discovering that, although the caterpillars of this moth committed such terrible ravages, and destroyed acre upon acre of grass, the succeeding crop was much improved in point of fineness and delicacy, and that, therefore, the insect conferred a benefit rather than inflicted an injury. Still, as the entire crop of one year was destroyed by them, it is evident that the optimists in question were not the proprietors of the land. Hilly and mountainous districts appear to be the favourite resorts of the Antler Moth, which seems to be one of the diurnal species, flying about with great rapidity for a short time, and then disappearing quite suddenly.

Mr. Wailes, who has given a detailed description of this moth, in the pages of the *Entomological Magazine*, mentions an example of this curious propensity. After stating that he had watched in vain for the moth in the early morning, and was about to return home, "suddenly, the whole field, as far as the eye could reach, was once more the scene of their gambols; the eye became bewildered with their motions; they were lost in the mazes of their evolutions. Sudden, however, as their appearance had been, their disappearance was equally so, as with one general consent, at about half-past eight, they again settled, and, their flight for the morning being over, scarce a solitary specimen was anywhere to be seen. They flew about three or four inches from the ground, and apparently very seldom alighted, but threaded their way most dexterously among the long culms of the grasses."

The colour of this moth is always variable, but the usual tint is greyish brown, mottled with black and chestnut, and decorated with a few patches of white. It is a small moth, not exceeding an inch and a half in expanse of wing. Though not a very frequent visitor, and extremely local in its habits, it possesses such powers of mischief, that it finds a place in this work for the purpose of putting gardeners on their guard.

THE members of the genus Mamestra bear a strong resemblance to each other, and require a careful eye to distinguish them rightly. They are all dressed in sober brown and ochre, and but for the damage which they inflict on the crops while they are in the larval condition, there would be few points of interest about them. Their larvæ are, however, among the most destructive of our garden foes, feeding upon various plants, and always keeping themselves out of sight, either hiding themselves under the ground, or burying themselves in the very heart of the vegetable on which they feed.

Our first example of these voracious creatures is the POT-HERB MOTH (*Mamestra oleracea*), sometimes called by the longer though more poetical name of the BRIGHT-LINE BROWN-EYE MOTH.

The larva of this moth attacks the lettuces, cabbages, and other garden herbs, and is particularly fond of the broccoli, having a habit of burying itself just below the surface of the ground, and there feeding on its favourite diet, concealed by the soil. This is one of the many subterranean larvæ which are to be found by scraping up an inch or two of earth round the stem of the plant, and, in common with them all, should be destroyed whenever seen. They all creep under the earth for the purpose of feeding on the roots and stems of plants, or of hiding themselves by day, so that they may carry on their depredations by night, and ought therefore to be slain by every attentive gardener.

This larva is rather variable in colouring, the ground tint being sometimes yellowish brown and sometimes green, upon which are drawn several stripes of dark brown and two of greyish white, on one each side, just above the feet. Between the dark stripes are a number of black dots. The fore wings of the moth are deep chestnut, mottled very indistinctly with dark brown. The hinder wings are much paler towards their bases, and have a dark band round their margins. It is not a large moth, measuring about an inch and a half in expanse of wing.

An allied species, the Cabbage Moth (*Mamestra brassicæ*), is even more plentiful than the preceding insect, and therefore more destructive.

The caterpillar of this moth feeds upon cabbages and lettuces, and in the months of July, August, and September may be discovered by moving asunder the heart-leaves of the plant, this larva being one of those that conceal themselves in the midst of the leaves. The caterpillar remains in the heart of the cabbage until it has attained its full growth, when it descends to the ground, and burrows into the earth, remaining in its subterranean abode until it has undergone its final change into the moth form. The perfect insect appears in May and June of the succeeding year, just in time to lay its eggs on the growing plants.

In some seasons this moth is extremely plentiful, and when that is the case it behoves the gardener to watch well his crops of the next year. There are, I believe, no other methods of keeping down the ravages of this insect except destroying the moth in the spring and hand-picking the caterpillars in the summer.

In general appearance, this caterpillar is not unlike that of the preceding species, but it is of a darker hue, the green tint not being so prominent, and the surface being variably mottled with grey and black. There is a dusky yellow spot down each side, and a dark streak along the back.

The moth may generally be found at night by means of a lantern; and if the gardener chooses to put himself to a little more trouble, and to sugar the walls and trees, he may not only destroy great multitudes of noxious insects, but, in process of time, will make a valuable local collection.

Sugaring is very easily performed. Take half a pound or so of sugar, dissolve it in beer, and boil the mixture until the two substances are thoroughly mixed. After dark, fasten a bull's-eye lantern on a belt, put a few spoonfuls of rum into the beer, take an entomological net (*i. e.* a gauze bag upon a wire ring fastened into a handle), a pair of forceps, a supply of pins, and a few boxes. For the latter articles may be substituted some strips of sheet-cork fastened inside the hat. Mark all the most convenient spots, such as patches of bare walls, the trunks of trees, &c.: stand opposite to them, and with a brush bestow your sugar and beer liberally within the circle of light thrown by the lantern; taking care, however, not to lay it on so thickly that it trickles down in little streamlets. Now pass to the next station, and repeat the process; being careful always to have your stations in a circle, so that when you have finished the last you may be close to the first.

If the grounds be tolerably large, the operation of laying on the sugar will occupy about half an hour. You may then disencumber yourself of the sugar-jar, and begin your rounds. Half an hour, at least, should intervene between the laying on of the sugar and the first visit; and the stations should not be too far apart, as in that case the odour of the sugar is less concentrated and not so effectual.

On going your rounds, you will see strange sights. Winged creatures of various kinds will be fluttering round the sweet allurement, their wings glancing like sparks of flame as they flit through the cone of light thrown by the lantern on the misty air of night. The glass of your lantern will be besieged by these nightly wanderers, and soft feathery things will come flapping against your hands and face, like animated snow-flakes. Sometimes the form of a bat will mark itself black and sombre against the sky; and on the trees, the ground, and the walls will be seen slugs of portentous dimensions, grey and black; while beetles of sober but polished exterior will pause in their quick, eager prowl, struck motionless with astonishment at the sudden glare.

Upon the sugared spots will be seen moths of all colours, shapes, and dimensions, so eagerly engaged upon their feast that they may be neatly picked off with the forceps, held a moment before the lantern so as to identify them, pinned into the hat if valuable, and if not, dropped into a basket strapped to the side, and carried home for the poultry or to increase the fertility of the leaf-heap. The pinch of the forceps will kill the moth if it be rightly held. Those insects which evade the forceps can be caught by a sweep of the net; and, indeed, many specimens will be captured merely by striking backwards and forwards at random about eighteen inches in front of the sugared spots.

When one station has been despoiled of its insect visitors, the next should be searched; and by the time that the round has been made, the first station will have recruited its numbers, and be ready for another visit.

Not only upon the sugar will the moths be found, but sitting on the neighbouring shrubs, on the wall, and even on the ground, being so completely intoxicated with the sweet banquet that they cannot move, and are captured without difficulty. The number of insects that can be thus taken is almost incredible; and as the greater number of the creatures that come to prey on the sugar are our bitterest garden foes, the plan is one of no small service. Even in the day-time, the sugared spots are not without their uses; for the wasps come by troops to them, and may be caught by day, as are the moths by night.

Even if the gardener be unable to move out of his house, he yet may gather a plentiful harvest of moths by painting a board with the sugared mixture, and placing it in a room where the windows are open. One of the most attractive traps for moths and wasps is an empty beehive—or skep, as it is sometimes called—from which the contents have been removed, but in which the perfume of the honey still lingers.

The colour of the Cabbage Moth is rather variable, but is generally as follows:—The fore wings are brown, clouded with darker hues, like tortoiseshell. On their front edges are pairs of black spots, from which proceed certain irregular black streaks that cross the wings. Nearly at the end of the wings there is a waved pale stripe, and smaller streaks and dots of the same colour are scattered about on the wing. The hinder pair of wings are light greyish brown, having an undefined broad blackish band near the tips. The average expanse of wing in this species is about an inch and a half.

THERE are nine or ten species of this genus, among which may be mentioned the DOT MOTH (*Mamestra Persicariæ*), a larger and a handsomer insect than either of the preceding. It is easily distinguished by its larger size, and the black fore wings with a conspicuous yellowish white spot nearly in their centre. The caterpillar of this moth is generally pale reddish brown, with a white stripe along the back and a row of green marks on both sides of the stripe. It is, however, very variable, as is generally the case with the insects belonging to this genus. It feeds on many plants, and is reckoned among our garden foes, because it damages the marigold, sunflower, and elder.

Our last example of these insects is the BROOM MOTH (*Mamestra pisi*), a much prettier species than any which has been mentioned, the colours being far less sombre. The fore wings of this moth are chestnut brown, deeply clouded, and variegated with spots and streaks of a paler hue, and the hinder wings are pale dusky yellow, marked here and there with blackish brown. The expanse of wing is rather more than an inch and a half.

The caterpillar is rather large, and is of a pale brown, with a tinge of red on the back and of green on the sides, and having some yellow lines drawn along the sides. It feeds upon many of our plants, and is therefore very injurious in a garden; the pea, the vetch, and their allies being the greatest sufferers.

CHAPTER XXIII.

MARBLED CORONET and its Relatives—Remarkable Habits of the Larvæ, and their Depredations—The MULLEIN MOTH : its Larva and Ravages—The LETTUCE SHARK—Why so called—GAMMA MOTH—Reasons for its Name—Its Depredations—Colour of the Larva—Appearance and Habits of the Perfect Insect—Some of its Allies and their Habits—The WINTER MOTH—Its Peculiar Appearance—Difference between the Sexes—Destructive Character of the Larva—Best Method of preserving Trees—CURRANT MOTH—Its Larva and Food—Strange Mode of Progression—Looping Caterpillars—Mode of killing them—Ravages of the Currant Moth Caterpillar—LEAF-ROLLER MOTHS—Origin of their Name—Their singular Titles—Their Larvæ and their Destructive Habits—Methods of checking their Increase—Various Leaf-roller Moths and their Habits—The OAK MOTH : its Colours, and the Damage done by its Larva—The Tineidæ : their Dimensions, Colour, and general Appearance—Various Tineidæ, and the Best Method of destroying them—The LONG-HORNED MOTHS—Why so called—Their Beauty and the Habits of the Larva—A remarkable Chrysalis—PLUME MOTH—Their elegant Shapes and delicate Colouring—Habits of the Larva.

THE pretty, but somewhat destructive, moth called the MARBLED CORONET (*Miselia compta*) belongs to a genus containing five or six species, several, if not all, of which are injurious to the garden. The caterpillar of this moth is greyish, marked along the back with a row of brownish spots, and feeds upon the lychnis, so justly a favourite flower in our garden.

The moth is rather small, measuring barely an inch and a half in expanse of wing, and is coloured as follows :—The fore wings are brown, mottled with a warmer hue, traversed by black markings and variegated by white spots. There is also a black mark on the wing, mostly resembling the letter N, but sometimes bearing a close resemblance to the capital X. The moth appears about June.

A closely allied species, known to collectors by the poetical title of MARVEL DU JOUR (*Miselia aprilina*), is very plentiful in many parts of England.

This handsome moth is much larger than the preceding, measuring about an inch and three-quarters in expanse of wing. The colour of the fore wings is pale green, scribbled all over with black, and patched with rich brown. One distinguishing mark of this species is a row of small angular spots, edged with white, that run just inside the outer edge of the wings. The hinder wings are blackish grey, with a dark patch in the centre, and a black streak just beyond the patch. The two black arches on the front of the thorax serve also to distinguish this species.

The caterpillar is very variable in colouring, but is generally ashen grey, with a dark stripe along the sides and dark lines and markings on the back. It is one of the nocturnal creatures, haunting trees, and feeding on their leaves by night, and concealing itself by day under the earth at their roots.

The apple often suffers sadly from the attacks of this caterpillar, and the gardener is much troubled to discover the depredator, the leaves being eaten away and no sign of the destructive creature being visible. In such cases the gardener may turn up the earth at the foot of the tree, and there he will probably discover the authors of the destruction snugly hidden just below the surface of the soil.

Another species of this genus, called EALING'S GLORY (*Miselia oxycanthæ*), is nearly as large as the preceding insect. It is sometimes called the GREEN BRINDLED CRESCENT.

This a pretty though not a handsome moth, exhibiting very pleasing tints when closely examined, but not possessing any brilliant or peculiarly striking colours. Its fore wings are shining brown, mottled with black, and variegated, as its name implies, with green. The hind wings are yellowish brown, with black veinings, and the body and abdomen are also brown. The caterpillar is brown along the back, clay-yellow upon the sides, and is variegated with black and white. It may be identified by the protuberance near the tail. It is rather a destructive creature, feeding on the whitethorn, and doing sad damage to our hedges.

THE soberly-coloured MULLEIN MOTH (*Cucullia verbasci*) belongs to a large genus, the members of which so closely resemble each other, that several of them can only be distinguished by the closest attention to minute details.

The caterpillar of the Mullein Moth feeds, as its name implies, on the verbascum, or mullein, so many varieties of which are cultivated in our gardens. It may be found on the leaves of that plant throughout the summer, and is rather a conspicuous creature. The colour is greyish white, with a wash of green, and notable from having on each segment four large black dots arranged in a square. Along the sides of the body run a number of smaller dots, and a quantity of bright yellow spots are sprinkled over the body.

The moth is rather variable in its hues, but is generally reddish brown, mottled, and streaked with black, and having in most specimens a broad whitish ribbon behind the middle of the wing. The hinder wings are red-brown, paler at the base. The perfect insect appears about May. The expanse of wing varies from an inch and a half to two inches.

This is perhaps the only species of the genus where the caterpillar feeds upon the leaves, those of the other species preferring the flowers. On account of their ravages, some of these creatures are popularly called sharks, as, for example, the LETTUCE SHARK (*Cucullia lactucæ*) and the LARGE DARK SHARK (*Cucullia lucifuga*), both of which specimens feed upon the lettuce while in their larval condition. The former of these insects is, perhaps, the largest and handsomest of the genus, measuring two inches in expanse of wing, and being of a rich brown, streaked with black and mottled with grey. The caterpillar is large, being rich yellow, spotted with large bold markings of black, and further decorated with circular red spots. Indeed, all the caterpillars of this genus are prettily coloured, that of the LARGE PALE SHARK (*Cucullia umbratica*) being black, with vermilion spots; that of the STARWORT MOTH (*Cucullia asteris*) yellow, with longitudinal lines of scarlet, pink, and white—green being in some examples substituted for the pink; while that of the SHEPHERD'S PROSE MOTH (*Cucullia solidaginis*) is green, with pink marks on the back, and short streaks of the same hu along the sides.

The moth which comes next on our list is known by mor than one name. To scientific entomologists it is ***Plusia Gamm*** and to collectors it is either the GAMMA MOTH or the SILVER Y all these titles being derived from the curious mark on the for wings, which much resembles the Greek letter γ or the Englis letter Y. More than one species has a mark of this shape o the wings, but they are distinguished from each other by th colour of the mark, one being the Silver and another th Golden Y.

The present species is by far the more plentiful, and it caterpillars are in some seasons and in certain localities terribl destructive. Pot-herbs of various kinds, and especially peas, ar devoured by this caterpillar, which has been observed passin from a garden which it has ravaged to one in which a supply o food still remained. Even in this country it is sufficiently destructive to be counted among our worst insect-pests; but o the Continent it is sometimes so numerous as to deserve th name of a pestilence, and to rank with the locust in its power of mischief.

In France it has been known to lay waste whole fields an gardens, eating all the soft parts of the leaves, and only rejectin the stems. Its presence was rendered the more injurious by on of those superstitions which always accompany ignorance. I was thought to be a venomous creature, and that the leaves o which it had fed were impregnated with poison. The consequence was that no one would eat the herbs, and the peopl were deprived of their soup for weeks together. To us in thi country such a deprivation conveys no very terrible idea, bu when it is remembered that the *potage* forms the chief food o the lower classes, the reader will comprehend that next to th failure of bread, that of the pot-herbs would be the most terribl

The caterpillar which works all this mischief is really pretty creature, pale grey in colour, and adorned with white an yellow lines along the sides.

The moth is one of the day-fliers, and may be seen even in the midst of the noontide sunbeams, exulting as it were in their warmth, and flitting about from flower to flower with a marvellously swift flight. It seldom makes a long stay with any individual blossom, but poises itself for a few moments, haunting the flowers of the clover, the wild mustard, and the pasture scabious, the last-mentioned plant being an especial favourite. In its flight it much resembles the humming-bird moth, that pretty, active creature, which every one knows, whisking about in the same quick eager manner, hovering in like fashion over the blossoms, and keeping its wings in such a rapid state of vibration that they are hardly visible.

On account of its great activity it is not very easily captured; but though it is one of the day-fliers, I have frequently caught it at night when engaged in sugaring the trees. As it darts off horizontally when alarmed, I have sometimes captured it by striking directly at the flower over which it was hovering, and so catching in the net the head of the flower and the moth together.

The colour of the Gamma Moth is rather complicated, but may briefly be described as follows. The fore wings are shining grey, mottled richly with deep brown, and having a large patch of that colour nearly in the middle, on which is placed the peculiar silvery Y-like mark which is so characteristic of the species. The hind wings are pale brown, with a broad, undefined band of a deeper tint round the edge. At each side of the base of the abdomen there is a remarkable white scaly process. The expanse of wing is nearly three-quarters of an inch.

The Golden Y (*Plusia iota*) is something like the preceding species, but can be distinguished by the colour of the Y-like mark, which is yellow instead of white, and more like the letter V than the Y. The caterpillar of this species is green; and as it feeds upon nettles, burdock, and other plants which we reckon as weeds, cannot be considered as one of our garden foes, and ought rather to be protected than destroyed.

Another common species of this genus is the Burnished-brass Moth (*Plusia chrysitis*), appropriately so named, as the wings are pale brown, crossed by two broad bars of greenish gold, or bronze, which shine in a side light as if they were made of polished metal. It is a very pretty insect, very plentiful, and rather injurious, the caterpillar feeding on one or two plants which we cultivate for the table. The caterpillar is green, with a white streak over the back, and a number of curved broken lines along the back.

There is a curious and somewhat destructive insect, which is popularly called the Winter Moth (*Cheimatobia brumata*), because it appears in the middle of winter, regardless of frost and snow. It may be seen along hedgerows, just flitting out for a few moments and then returning to its shelter. This moth, simple and elegant as it looks, is in reality one of our worst garden foes, damaging the fruit-trees in a terrible manner. Hardy in the severest frost, as an Esquimaux among his eternal snows, the Winter Moth survives the most inclement weather; and the male flutters about, and the female crawls to her task in defiance of a temperature that drives us to our warmest clothing and our fastest pace.

In this species the male alone is furnished with wings, *i.e.* with wings capable of flight, those organs in the female being mere little projections from the thorax, scarcely larger than the wing-cases of an earwig. The colour of the fore wings is grey, scattered over with delicate blackish lines, as seen in the illustration, and the hind wings are of a whiter tint, sometimes with a dark line through their centre. The colour of the body is yellow. The female is simple brown.

On account of her small dimensions, and dull brown colour, the female Winter Moth is seldom seen. Few persons, except practical entomologists, or gardeners, care to employ themselves during the winter months in looking for insects, or in watching the trees and shrubs, and therefore this little soberly-clad creature escapes observation. Small as she may be, she is a worse and more formidable enemy than the largest moth that flaps its wings in this land, and the damage that she does in her own quiet insidious manner is sometimes incalculable. Though she cannot fly she can crawl, and accordingly she ascends the trees unseen, her brown, wingless body harmonizing so well with the bark, that it is scarcely visible, and sets about her work of destruction.

Creeping to the top of the tree, she seeks the yet unopened buds, and lays her tiny eggs upon them, and also upon the young shoots. When the warm days of spring cause the buds to break their bands, and to put forth their tender leaves, the eggs are hatched by the sunbeams, and give forth a number of minute blackish grey caterpillars, which speedily bury themselves in the bud. These creatures grow rapidly, and soon cast off their simple grey clothing, assuming instead the pretty raiment which they will retain until the time arrives for them to enter the pupal state. The colours of the half-grown caterpillar are green, with a blue line along the back, and two yellow lines upon the sides.

When they have reached this stage of their growth, their wings render them rather conspicuous, though their colours harmonise so well with the tint of the leaves and blossoms that when on the tree they are not seen so readily as might be imagined by any one who saw them in a box or on the ground. In their earlier stages, however, they are eagerly sought by the little birds, whose microscopic eyes, sharpened by hunger, are able to detect even the lurking caterpillar of the Winter Moth, and drag it from its concealment; sometimes dragging off in their eagerness the bud as well as its inhabitant. I am always glad to see these little birds at work among my trees, knowing that they are doing good service, and that even if they do pull off a few buds, no harm is done, those buds having already been doomed, and their vital principle destroyed by the caterpillar within.

These caterpillars are by no means restricted to one kind of food. The apple is their favourite tree; but various other trees and shrubs fall victims to their voracity. The rose, for example, is often sadly damaged by the larva of the Winter Moth, the "worm i' th' bud," from which Shakspeare has taken one of his most delicate images, and the hazel, the lime, the hawthorn, the elm, and the willow, are alike sufferers from its ravages.

When the caterpillar is full fed, it leaves the tree on which it has passed its life, and, descending into the ground, there casts off its last larval skin, and assumes the form of the chrysalis. May is the month in which this change generally takes place, and the creature lies safely in the ground until November or December, when it emerges in the perfect form.

Several plans have been proposed for the destruction of this moth, but I think that none is so effectual as the encouragement of the small birds, whose quick eyes can perceive, and whose sharp beaks can capture, the tiny but destructive insect, which escapes the eye and hand of the human being. The ichneumon flies, too, do good service, and indeed, if for one year only, the birds and ichneumon flies were banished, the succeeding season would witness a scene of devastation which we trust may never be beheld in this land.

THE prettily-coloured CURRANT MOTH (*Abraxas grossulariata*) is a very common and well-known insect in this country, and is remarkable for the fact that the moth, the chrysalis, and the caterpillar, are decked with similar colours.

As its name imports, the larva of this moth feeds upon the currant, and to those gardeners who grow many currant-bushes, is a very troublesome foe.

Happily, its boldly-contrasted colouring renders it rather conspicuous, so that the gardener's most certain remedy, hand picking, can be employed without much trouble. It is one of the looper caterpillars, *i.e.* those which proceed by a succession of steps, seizing an object with the legs in front of their bodies, bringing up the claspers at the tail close to the fore legs, and so raising the body into a loop, very like a cat when she is angry and arches her back, and then pushing the fore legs onwards to take a fresh hold.

The power of the legs, or rather claspers, at the end of the tail, is extraordinary. By these organs the creature can hold itself out horizontally for an indefinite length of time. Many species of looper caterpillars assume this remarkable attitude when reposing, fixing their claspers upon some branch, and holding themselves out so straight and so motionless, that almost every one would mistake them for dry, broken twigs. Their colour also, which is greyish brown, and the slender make of their bodies, aid greatly in carrying out the deception, while the projections upon the two or three first and last segments look exactly like the dead buds upon the twigs.

All these larvæ are very cautious in their movements, and extremely wary, always drawing from their spinnerets a thread by which they may be suspended lest they should be shaken from their hold, or in case they should be frightened, and endeavour to save themselves after their usual custom, by dropping to the ground by means of this silken cable, and re-ascending by the same means when they think the danger to be over. They always drop by jerks, a few inches at a time, and very often do not trouble themselves to descend as far as the ground, but arrest themselves half-way down, and there hang, or revolve slowly, as if they were being roasted, until they deem themselves out of danger. On a windy day they afford a very amusing spectacle, swinging away as if in sport, and often yielding so completely to the power of the wind, that they are blown almost horizontally from the branch to which their threads are attached.

The least jar upon the branches will cause the caterpillars to descend in this manner, and the knowledge of their habits enables the gardener to destroy his foes by hundreds; all he has to do is to tap the branches with a long stick, and then to catch the caterpillars as they come dropping down, suspended by their threads. Thousands may thus be gathered by an experienced practitioner, the chief point being a knowledge of the manner in which to tap the tree. If the branches be struck too smartly, all the caterpillars will be so frightened that they will come down simultaneously, and half will escape, while the gardener is picking up the other half; but by tapping the boughs quite gently, the caterpillars let themselves down gradually, so that, by degrees, every one may be quietly captured.

When they re-ascend the tree, they gather up their cables as they climb, rolling up the thread into a little packet, by means of their legs. Spiders have a similar custom, as any one may see by watching them ascend their silken ladder.

The caterpillar of the currant moth feeds indiscriminately on the shrub from which it derives its name, upon the gooseberry, the peach, and even the sloe and almond. If not removed, it does very great damage, stripping off all the green portion of the buds, and reducing them to the bare midrib. Care, however, will soon effect a great diminution in the numbers of these creatures. As the moth lays her eggs upon the leaves in the middle of autumn, one very certain plan is to strip off all the leaves about September and to burn them. Every moth should also be killed, a task of no difficulty, as the flight is by no means rapid, and the moth seems to be less wary than the caterpillar.

The colour of the fore wings in the perfect insect is yellowish white, spotted variably with black, and a pale orange belt crosses the wings. The hind wings are coloured in much the same manner, but there is no orange band. The body is reddish-yellow, spotted with black. The expanse of wing rather exceeds an inch and a half. The caterpillar is yellowish white, striped with orange upon the sides, and spotted with black, and the chrysalis is black-brown, the abdomen being encircled with orange belts.

We now come to a very large family of very little moths, that we call scientifically Tortricidæ, or twisters, and popularly Leaf-rollers, because the larvæ roll up the leaves in which they dwell, and form them into hollow cylinders, disfiguring and destroying them at the same time. All gardeners have been annoyed by these leaf-rolling caterpillars, and noticed the little active being within the leaf, which can wriggle either backwards or forwards with equal speed, and which has so many opportunities of employing its agility.

The leaves are not always rolled in the same manner, the various species employing different methods of forming their temporary habitations. Sometimes they roll the leaf from the tip, sometimes from the side, and in some cases they cut a slit deeply into the leaf, and only roll up a portion. Others bend an entire leaf longitudinally, while others seize upon a tuft of leaves, and draw them together into one mass. But, whatever may be the shape of the habitation, the silken thread forms the bandage by which the leaf is bent and held in its proper position.

Before commencing the formation of its leafy home, the caterpillar institutes a careful examination of the leaves, trying them in succession, and rejecting those which are not sufficiently pliable for its purpose. It then attaches a row of silken threads to the edge of the leaf, and pulls them one by one until the leaf is slightly bent over. As the creature pulls the cables it draws them tight, and then spins a fresh set, hauling on them until the first set hang loose and useless. By a repetition of this simple process the leaf is forced into its proper form. Still, it is rather a mysterious process, because the caterpillar is so small, and its muscular power so trifling, that the force which it can apply to the leaves seems quite inadequate to the effect produced upon them, particularly when we look at the tightly cylindrical form into which some of the leaves are rolled.

The caterpillar always resides within the leafy cylinder, secure from many foes. The little birds often come to the leaves, peep into the cylinder, see the caterpillar, and insert their beak for the purpose of seizing the little creature. But no sooner does the bird put its beak into one end of the cylinder, than out pops the caterpillar at the other, lowers itself to the ground by its silken thread, and does not return until its foe has retired.

The sparrow, however, soon learns to counteract this manœuvre, and instead of trying to pick the caterpillar out of its cylindrical nest, merely shakes it violently, waits until the inmate has descended to the ground, and then follows and picks it up leisurely.

Our first example of the Leaf-rollers is the **Bergmannian Moth**, otherwise called the **Roseleaf-roller** (*Argyrotoza* [or *Croesia*] *Bergmanniana*), one of the most plentiful of its kind, and certainly one of the most annoying to the ornamental gardener.

The caterpillar of this moth is very mischievous among the rosebuds, destroying them in a hopeless manner, and, indeed, being so thoroughly fatal to the plant, that the only method of saving the flowers is, to cut off the affected shoots and burn them, together with the buds. Hand picking may sometimes be employed with good effect, but in any case the gardener must take care not to alarm the caterpillars, and permit them to save themselves by dropping to the ground.

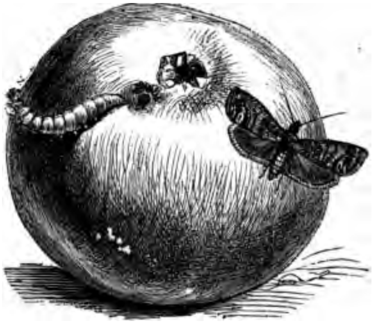
The moth is a beautiful little creature, the fore wings being rich golden-yellow clouded with orange, and mottled with several rich brown bands. There is on each wing a slightly curved line of silvery scales, and similar scales are scattered upon the dark bands. The wings are fringed with pale yellow. The hind wings are quite dull, being simply deep sooty brown, without any gloss, and destitute of the silvery scales which are so beautiful on the fore wings. The head and thorax are yellow. All these moths are small, their expanse of wing seldom exceeding half an inch, and often not reaching even those dimensions.

ANOTHER of the bud-destroying species is the BLACK CLOAK MOTH (*Spilonota cynosbatella*). This moth has met with the fate that seems to befal all the smaller insects, and has been called by a variety of names, so that it is no easy matter to identify the species of which any particular author may have been writing.

The caterpillar of the Black Cloak Moth is popularly known by the name of Red Bud caterpillar, a title which is certainly appropriate, because the colour of the larva is deep fleshy red, and it feeds upon the buds of the pear and apple. The head is black, and a greyish-brown line runs along the back. The fore wings of the moth are whitish grey, mottled and patched with black and grey, and deeply edged with brown. The hinder wings are simple brown. The perfect moth is found towards the end of summer and the beginning of autumn, and the caterpillar is only seen while the buds are in blossom.

An allied species, the BROWN CLOAK MOTH (*Spilonota aquana*) is very destructive to the rose. The caterpillar of this moth is not unlike that of the preceding, but there is scarcely so much red about it, and it is covered with black dots and lines, the latter being very delicate. The moth appears in the early summer. There are many species of this genus, all injurious in some respect, and therefore to be ranked among the foes of our gardens.

We now come to two species of a peculiarly destructive genus. Our first example of this genus is the well-known CODLING MOTH (*Carpocapsa pomonella*), a species of which the perfect insect is but seldom seen, and the larva is seen far too often.



APPLE-MOTH AND GRUB.

When I was a little boy, I used to be very grateful to the Codling Moth, for I was permitted to take any apples that had fallen on the ground, on the condition that I did not mount nor shake the trees, nor knock the fruit down by any unfair means. The caterpillar of the Codling Moth is the creature which produces in apples the effect which is called "worm eaten," and which causes them to fall before they are really ripe. Still, the check which is given to their proper growth by the ravages of the caterpillar causes the saccharine principle to develop itself sooner than would otherwise be the case, and even had the fruit not been sweet, I fancy that it would have been eaten just as certainly.

True, within the apple there was always a grub, but a boy thinks little of a grub when an apple is in view; and besides, to eat the apple without biting the grub was always a pleasing puzzle when the knife was lost, and when it was present an excellent opportunity was offered for its dexterous use. Therefore, though feeling the strongest objections to the Codling Moth in my own orchard, I cannot but entertain a kindly remembrance of the benefits which it used to confer upon me in years long passed away.

All fruit found on the ground under the trees should be at once picked up, and the grub destroyed, otherwise the insect will attain its perfect state, and become the parent of a numerous offspring. The colours of the moth are not brilliant, but are arranged in a very pleasing manner. Ashen-brown is their grand colour, and upon which are drawn a number of black-brown lines, and near the inner angle is placed a large reddish patch with a golden lustre in certain lights, and clouded with deep chocolate brown. The hind wings are dark brown, deeper at the edges than at the base. The caterpillar is simply whitish grey, with a dark head.

THE next example of these moths is the PLUM-TREE MOTH, sometimes called the WŒBERIAN MOTH (*Carpocapsa Wœberana*).

The larva of this moth is, as its popular name denotes, destructive to the plum-trees. It does not feed upon the fruit like the larva of the codling moth, but upon the inner bark of the tree. By continually feeding it loosens the bark, and so in time causes the tree to decay. The presence of this destructive larva can mostly be ascertained by the little round holes in the bark, and the reddish-yellow powder which may be seen in heaps at the orifices. Most of these stonefruit-trees seem to be attacked by this insect, which feeds equally on the plum, the apricot, and the peach, and is sometimes found revelling on the bark of the almond. The colour of the larva is green, with a reddish head. When it is about to change into the chrysalis, it makes a yellowish cocoon, very rough on the exterior, in which it resides until it assumes the perfect form.

To the casual glance the colour of the moth is rather dull and sombre, but when examined carefully it exhibits a wondrous beauty. Let me here mention that almost any of our moths, no matter how dull, how insignificant, or how sombre, will, when placed under a good microscope, and properly illuminated, flash out into glories such as its apparently simple colouring scarcely seemed even to indicate. The ground colour of the fore wings is tawny, and they are variegated with delicate lines of rich brown, gold and silver, and with various mottling or patches of black, gold, and chocolate. The hind wings are sooty brown, fringed with a paler hue.

There are eighteen or nineteen British species of this genus, one of which chooses a remarkable plant for its subsistence, namely, the common wormwood, and in spite of its intense bitterness, feeds and thrives upon it. On account of this strange diet the species is called the Wormwood Moth.

When entomologists find themselves committed to such a task as giving popular names to the vast army of the Tortricidæ, many of which are so similar to each other that a very close inspection is needed before their marks of difference can be discussed, it naturally follows that they are obliged to give loose to their fancy, and to invent the most fantastic titles before they can hope to supply each moth with its name.

Sometimes, when they know its habits, the moth is named after the plant on which the larva feeds, or after some peculiarity in its movements. Sometimes it is named in compliment to some eminent person, usually a naturalist. Oftentimes it is named in accordance with its colouring; but there still remain very many species which would be without names, the appropriate title having previously been given to some other species.

In such instances, it is needful to use the inventive faculties, and so we have a whole host of Carpet Moths, Cloak Moths, Mocha Moths, Scallop Moths, Pearl Moths, Wave Moths, Pug Moths, Tabby Moths, Marble Moths, Bar Moths, Crescent Moths, Button Moths, Ermine Moths, Veneer Moths, and others too numerous to recount. Moreover under each of these headings a great number of species are ranked. For example, I have just run my eye over a catalogue, and roughly counted thirty-four carpet moths, thirty-five pug moths, twenty wave moths, and twenty-seven button moths. I make these observations in order to explain the extraordinary titles which are given to many of the little moths upon which we are at present engaged.

Our next example of these creatures is the BLACK STRIPED-EDGED MOTH (*Eudiopsa* [or *Pseudotomia*] *nigricana*). This moth is the parent of the formidable little caterpillar that is known to gardeners by the name of the Red Plum Grub.

This larva performs the same mischievous office towards the plum as does that of the codling moth towards the apple. The female deposits her eggs upon the plum, and when the young are hatched they burrow into the fruit, and settle themselves in its very interior, close to the stone. The best method of checking the ravages of this insect is to shake the branches before the plums have ripened, collect all those which fall, and kill the little red grub which will be found in their interior.

If this precaution be taken, the creature will be captured before it has attained its full growth, and will be found still in its fruity nest. Otherwise, if the plum be allowed to fall of its own accord, the caterpillar creeps out of the fruit, makes its way to the tree, and hides itself under the bark, where it changes into the chrysalis condition, forming a cocoon in which it may lie securely through the winter; therefore, the gardener will act wisely if in the late autumn he searches under all the loose bark, and destroys every cocoon which he may find.

The colour of the perfect insects is very sober, except when the rays of the sun fall slantingly on them. Their general tint is deep black-brown, but when viewed in a strong side light a gloss pervades the surface, and a number of golden scales are seen, forming an edge to some blackish marks. The hind wings are greyish-black, and both pairs are surrounded with a white fringe which in certain lights shines with a silvery lustre. The moth is generally seen in summer and autumn.

The genus to which this moth belongs is a large one, containing about twenty-five species.

THE last example of these moths which we can figure in this little work is the TAWNY DOT MOTH (*Euchromia fulvipunctata*). The generic title of this moth signifies beautiful coloured, and the name is well deserved.

The fore wings are reddish brown, and towards their extremities are a number of red dots, some of which are gathered together so as to form an indistinct streak. In some specimens the red dots are replaced by black, and in every case the colouring is somewhat variable. The hind wings are merely brown, edged with a white fringe. The larva of this insect is one of those which is destructive to the pine trees, the eggs being laid in the buds, and the growth of the tree being necessarily checked by the depredations of the caterpillars.

Another fir-destroying moth is the ORANGE SPOT (*Orthotænia Turionana*), a very pretty species, having its fore wings of a rich warm brown, covered with orange lines, curved so as to form a definite pattern not unlike that which is seen on many tropical serpents. The caterpillar is reddish brown, and may be found within the young shoots of the fir-tree, not only passing its larval life there, but also remaining within that place of concealment during its existence as a chrysalis.

IT would scarcely be right to omit a passing mention of an insect belonging to the typical genus of this important family. The PEA-GREEN OR OAK MOTH (*Tortrix viridana*), is a remarkably pretty insect, the fore wings being bright leaf green, with a very slight whitish line along their front edge, and the hinder wings ashen brown. The caterpillar is also green, but not of so vivid a tint as in the perfect insect.

The caterpillar of the Pea-green Moth is one of the most destructive foes of the oak, and any one who knows practically the number of noxious creatures which find their subsistence upon this tree, will understand the force of this assertion. In some seasons the caterpillars swarm to such a degree that whole trees are stripped of their foliage, first the green portions being consumed, then the nervures, and lastly, the very midribs.

A rather strange result followed upon a more than usually bad year. Good came out of evil—the pest defeated itself—the invading army ate up all the provisions, and so starved themselves to death. In fact, the numbers of these caterpillars were so vast, that they devoured all the leaves before they were half-grown, and, in consequence, the greater part of them perished before coming to maturity.

In some seasons these insects appear in vast hosts. They play around the oak-trees in multitudes, flitting about in the sunshine like the gnats over stagnant waters; and if you shake or strike the branches, or even kick the trunk of the tree, a perfect cloud of moths rushes out, and the air is filled with them as if the clouds were snowing moths.

Were it not for certain insect friends that range themselves under our banner, we should lose many a grand old tree by this moth. Fortunately, however, it has many foes. Birds are extremely fond of the Pea-green Moth. It is tolerably fat, not quick of wing, and its bright colours render it very conspicuous. Then, the ichneumon flies perform their share of the duty, and the wonderful little empis fly destroys perhaps as many as either of the previously-mentioned enemies, plunging its beak deep into the victim's vitals, and draining its juices. It is a strange moth; common yet rare—local, yet scattered. In one year, while walking among the oak trees, you will be positively annoyed by the swarms of these green moths that flit from every bush; in the succeeding year you will scarcely find a single moth. Isolated individuals are seen everywhere, but their masses are always local. One admonition may, however, be given. Whenever you see a smallish moth with green fore wings, and grey hind wings, be sure to destroy it, for it is one of the garden foes which deserve no mercy at your hands.

ANOTHER vast family of moths now comes before our notice, all of which are terribly destructive, though their injurious powers are not always exercised upon the garden. All the members of this family are of small dimensions, and some are so very small that they scarcely appear to exceed the common gnat in size. Many of the Tineidæ, as these moths are called, feed while in their larval condition upon woollen fabrics, fur, feathers, &c. and are popularly known to housewives by the name of clothes' moths. Some of them infest granaries, and are as destructive among the grain as the corn weevil itself, while some live upon trees, and others under their bark.

Our first example of these insects, the BARK MOTH (*Tinea corticella*) affords an instance of the last-mentioned kind of destructiveness.

The moth is small and prettily though not brilliantly coloured, the brightest hue being ochrey-yellow. The fore wings are greyish white, with a triangular spot of ochrey-yellow in the middle, and a number of dark brown marks scattered over their surface. In this genus the markings are, however, extremely variable, and it is thought by modern entomologists that more than one received species is in reality nothing but a simple variety. The task of distinguishing the species is always a difficult one, and in many instances the points on which these distinctions are founded are merely arbitrary, and vary according to the cabinet in which the insects happen to be placed.

The larva of this species resides beneath the bark of fruit trees, and the moth itself may be taken in the daytime, seated on the trunk of the trees, its minute dimensions and the mottled-brown colouring of the wings rendering it so inconspicuous that it cannot easily be seen. It is always a good plan after examining the trunk of the trees carefully, to strike them a smart blow. The insects that have settled upon them are startled by the concussion, fly off, flutter about wildly for a few moments, and may easily be captured on the wing by a sweep of the net, or even by a smart stroke with the hat. All moths taken in such positions may safely be reckoned among our enemies.

An allied species, the MOTTLED WOOLLEN MOTH (*Tinea granella*) does not feed, as might be conjectured from its popular name, on woollen substances, but upon grain, and is terribly mischievous. The ravages of this insect are the more injurious because it leaves no external indications of its presence.

The mother moth lays her eggs upon a grain of corn, and when the young are hatched they diverge in all directions, each claiming a separate grain of its own, and burying itself within its new home. Here it remains during its larval state, gnawing away the interior of the grain, and leaving the husk entirely untouched, so that no one would think that within the apparently sound grain there was little but a caterpillar and a heap of dust. Not until the caterpillar has completed its feeding does it give any signs of its presence. Just before it changes into the chrysalis condition, it leaves the now empty grain, and trails a silken clue after it as it creeps away in search of another domicile.

Strange to say, it is almost as injurious after it has left the corn as while it was devouring the grain. Instead of attacking the corn, it attacks the wood of which the storehouse is built, and burrows deeply into the floor and joists, for the purpose of making a secure home wherein it may complete its final change. The power of jaw possessed by this little creature is really astonishing. It bores through the wood with perfect ease, driving its burrow to a considerable depth, and passing even through the hardest knots, saturated as they are with turpentine. Some buildings have been quite ruined by these tiny depredators, the planks and timber being converted into a very honeycomb by their numerous burrows.

THE reader will find upon the plates an illustration of a pretty but mischievous little insect, termed the TRIPLE-SPOTTED BLACK MOTH (*Incurvaria* [or *Lampronia*] *capitella*).

The larva of this moth is injurious to the currant-trees, and in many of its habits resembles that of the great clearwing moth, already described on page 336. This caterpillar attacks the young shoots, and burrows deeply into them, feeding on the pith, and working so much damage, that the bushes are often destroyed by these hidden enemies. Especial pains should be taken to capture and destroy every moth that can be seen in the garden, as the very insidiousness of its attacks renders it the more noxious. As it is one of the diurnal species, it may be taken without much difficulty, and it is only too common in any places where currants are grown.

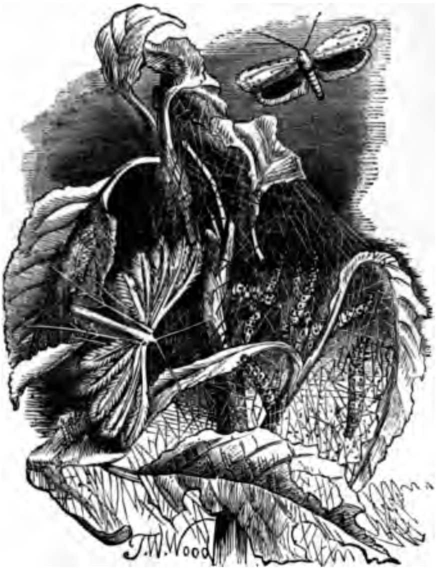
It is rather a conspicuous species, though its dimensions are small. The fore wings are deep purple-brown, with a peculiar metallic gloss, which is to be found in all the species of the genus to which it belongs, and is an indication that the moth flies by day and not by night, the sunbeams seeming to reduce the metallic splendour of its scales. Upon each wing are three golden yellow spots, that shine out boldly by their contrast to the deep purple brown of the ground colour. The hind wings are simply pale brown. The moth is generally seen about the end of May and the beginning of June, being a little earlier or later, according to the season.

An allied species, the FOUR-SPOTTED BLACK MOTH (*Lampronia rufella*) is sometimes the cause of much damage to trees, the larva boring into the trunks and remaining there until it has changed into the perfect form. On examining the trunks of the fruit and other trees, the empty chrysalis cases may be seen protruding from the bark, and affording indications of past ravages. This moth is not so dark as the preceding species, the fore wings having more brown and less purple, and the spots being four instead of three in number. Moreover, the colour of the spots is white instead of golden yellow, and they are arranged in definite pairs. There is in some specimens a very small supplementary white spot near the base of the wing and upon its edge.

As is frequently the case with insects, and especially with those belonging to the lepidopteran order, we see in the SMALL ERMINE MOTH (*Yponomeuta padella*) one of the prettiest species, and one of our worst garden foes.

It is hardly possible to conceive a more elegant moth or a more destructive caterpillar. The moth is delicately and gracefully made, with a slender body and long narrow wings. The fore pair of wings are of a peculiar satiny white, with a soft, silken gloss that is quite indescribable, but can never be forgotten when once seen. Their white is not pure white, but has something of the dove-grey in it. Upon this glossy surface are scattered a great number of tiny black dots, producing an effect similar to that of ermine, or rather, of minever. The hind wings are simply dark brown. The colour of the caterpillar is ashen white, spotted with black.

This creature is one of the social larvæ, being found in vast quantities upon the branches, and in course of time enveloping whole trees in their silken nets. Leaves and verdure vanish before their presence, and in course of time, a fruit tree that



LITTLE ERMINE MOTH AND WEB.
[For the White-plume Moth, see page 393.]

once presented a heavy mass of foliage is changed into a staring mass of bare boughs and twigs, covered with whole sheets of web, just as if it had been inhabited by an army of spiders. Later in the year the silken threads not only envelop the branches, but extend to the ground and to neighbouring trees, dotted here and there with the little caterpillars that are industriously crawling along them. Hundreds of caterpillars may be seen swaying at the end of their lines, and waiting until the wind blows them against some object. They immediately grasp it with their prehensile feet, fasten the end of their rope, and so establish a bridge, which they can cross at pleasure.

The strength of these slender lines is wonderfully great. As they are blown across the face they feel as if they were rather threads of fine sewing cotton than the delicate filaments of a tiny caterpillar. When a number of them happen to be so placed that they act unitedly, they exert a very sensible force upon the hat as the observer passes under the tree, and though they are not strong enough to pull off that article of dress and keep it suspended, as is the case with the webs of some exotic insects, they at all events cause the hand to move involuntarily towards the hat.

Among the garden trees, the whitethorn and the apple seem to form the favourite food of this destructive larva. I have seen one of the former trees completely devastated by these creatures, which had traversed the boughs as regularly as if they had been engineers, mining their way to a besieged town. One branch only remained green and flourishing, but it was doomed to inevitable destruction. Already the scouts, if we may so call them, had made their preliminary investigations; a few lines were visible, as they glittered in the sunbeams, and stretched from the main body of the caterpillars to the still green leaves, and the little dark spots that moved slowly along the threads indicated that the caterpillars were already on their way to take possession.

Hundreds of them dangled from their silken ropes, others were plentiful on the ground, while every wall and post within some distance was covered with these black-spotted larvæ, as they moved along in search of a quiet spot in which they might lie undisturbed while in their helpless pupal state.

The cocoon of this moth is seldom hidden, and in most cases it is simply placed in the web wherein the caterpillar has passed its life. The careful gardener can, therefore, always prevent the damage of a second brood. Even when in their larval condition the tree can be disencumbered of them, by the simple plan of shaking the branches, and catching the larvæ as they descend, and afterwards removing all the webs and burning them, in order to secure the few individuals that might have escaped from the previous operation. Every moth that is seen should also be killed, and as the creature is so very conspicuous, the task is by no means difficult.

An allied and still more beautiful species of this genus is rather injurious to the trees on which the larva takes up its residence, though it is not so utterly destructive as the preceding species. This is the LONG-HORNED MOTH (*Adela De Geerella*), a most lovely little creature, notable for the enormous length of its antennæ, which are fine and delicate as hairs, and glitter with iridescent tints as they wave in the sunbeams. A branch on which sit two or three of these little moths affords a wonderful sight. At a little distance the creatures themselves are not distinguishable, but slender flashes of coloured light play about backwards and forwards unceasingly, and without any apparent cause. This appearance is caused by the reflected sunbeams as they flash from the delicate antennæ, which are waved about in the breeze in graceful and ever changeful curves.

The fore wings of this moth are of a lovely soft brown, over which are drawn a number of longitudinal golden streaks, and which are further decorated by a yellow band, edged with black and silver. The hind wings are purple-brown, with a bronze reflection. The larva of the Long-horned Moth, is in some seasons extremely injurious to the trees, feeding upon the leaves, and making a kind of moveable cocoon in which it resides, and within which it can wholly conceal itself. The form of the habitation is somewhat flask-shaped, the head of the caterpillar protruding from the mouth, and the base projecting from the leaf.

In due course of time the caterpillar changes into a chrysalis, and it is a remarkable fact, that the long antennæ are disposed of by being first drawn down the body, as is the case with other lepidopteran insects, and then rolled round the end of the abdomen. The chrysalis lies in a web of rather curious construction, which is hung hammock-wise between two branches. The moth is seen about June.

There are nine or ten species of this genus, all having the long slender antennæ, and all being decorated with beautiful shining plumage. The male is at once known by the very large eyes, and the structure of the antennæ, which are larger than in the opposite sex, and are further distinguished by the two or three enlarged and hairy joints at their base. A very common and very beautiful species is the GREEN LONG-HORNED MOTH (*Adela viridella*), the fore wings of which are shining golden green, and the hinder wings purple-brown, edged with a fringe of the same colour as the upper wings. Some species are coloured with ochreous yellow, others with a fiery copper, and others with golden brown. All have similar habits, and can be recognised by their rather peculiar shape, and the very long antennæ.

ANOTHER of our garden enemies is the quiet-looking ROCKET MOTH, or GREY STREAK MOTH (*Plutella porrectella*).

As may be gathered from the popular name of this insect, the caterpillar feeds upon the rocket, and often works considerable damage in a garden. The buds of this plant form the favourite resting-place of the caterpillar, which draws the leaves together with its silken cords, and so is enabled to feed concealed from the generality of foes. This larva is found about the end of April and the beginning of May, and its presence may be detected by the manner in which the leaves of the plant are drawn together into a mass.

On examining these leaves more closely, the silken threads can be distinguished by which they are tied together, and on pulling them asunder, the little green caterpillar will be discovered in their midst. In this sheltered spot the larva resides, feeding luxuriously upon the young and tender leaves, and completely checking the further growth of the plant from the spot which it selects for its residence. Generally, there is only a single caterpillar in each bunch of leaves, but in some cases four or five specimens are found in close proximity to each other, all encompassed by a common leafy envelop.

The best method of clearing the plants of these tiresome pests is probably by drenching them well with tobacco-water; and it will be advisable for the gardener to separate the leaves, so as to permit the poisonous liquid to flow over the enclosed caterpillar. The simple plan of pinching the bud is often successful; and if the affected plants should be few in number, and the gardener have plenty of time at his command, the little grubs can be neatly extracted by means of the little brass forceps which every entomologist carries in his pocket.

The fore wings of this common little moth are greyish white, sometimes having a slight yellow tinge, and are diversified with patches of black and brown. Their inner edges are always deeply but irregularly waved, like the edges of many leaves. The hind wings are very pale brown.

When the larva is about to change into the pupal state, it spins a remarkably pretty cocoon, formed of silk, and having large open meshes. There are two kinds of this moth, one appearing in June, and the other in August.

We are now drawing near to the conclusion of the Lepidoptera, and can only find space for one or two more examples of these insects.

There is a darkish-coloured little moth, very common in gardens, which is known to collectors as the COARSE WAINSCOT MOTH (*Depressaria nervosa*), and is sometimes called the CARROT MOTH, on account of its food. The generic title of Depressaria is given to this group of moths because their bodies are so very flat, looking almost as if they had been squeezed by some superincumbent weight. The abdomen is rather long, and, when the wings are closed, its extremity projects a little beyond their tips.

The moth is not so small as many of those which we have lately examined, the expanse of its wings measuring about three-quarters of an inch. The colour of the fore wings is rich red-brown, and nearly in the middle are placed two very small white dots, each dot being edged with bright red. The hind wings are of the same colour, but extremely pale, as if washed out.

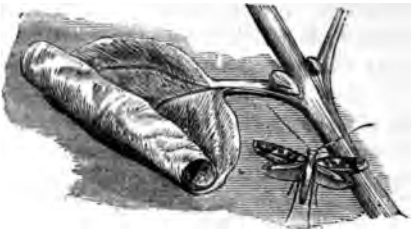
The caterpillar of this moth is very injurious to carrots and parsnips, living upon the flowers, and preventing them from producing seed. Its colour is greyish green, dotted with black tubercles. Other species of this genus feed on the same plant, but this species has been selected because it is very common, and easily identified by the two white spots upon the dark red wings. This genus contains twelve or thirteen species, and none of them seem to possess any brilliancy of colour. The caterpillar of one species, the Thistle Flat Body (*Depressaria carduela*), feeds upon the different varieties of the beautiful centaurea, and sometimes sadly disappoints those who visit the plants and expect a bouquet therefrom. The moth is not very often seen, and appears in July. It is smaller than the coarse wainscot moth, the expanse of its wings measuring barely half an inch. It may be identified by the three tiny black dots on the red-brown fore wings, and the ochery yellow of the hind wings.

Another species of the same mischievous genus is easily recognised by the red S-like mark on its fore wings, and in consequence of this peculiarity is popularly called the Red Letter Moth (*Depressaria ocellana*).

This moth is generally to be taken on hedges and in the outskirts of woods, and is mostly seen in the months of July and August. The ground colour of its wings is ashen grey, with darkish indistinct streaks, and in their centre is a deep blood-red mark, just like the letter S, having a white dot within it and two black dots at its base. The hinder wings are pale brown. The expanse of wing is about three-quarters of an inch.

The larva of the minute but mischievous Pear-blister Moth (*Argyromiges Clerckella*) is, as its name imports, very injurious to the pear-tree. The larva, which is of very small dimensions, feeds upon the leaves of the pear-tree, and raises the epidermis into blisters, by which its presence can at once be detected.

There are many species of this genus, and in most cases the larvæ produce those remarkable winding tunnels between the two membranes of leaves, which are so familiar to those who watch carefully the progress of their plants. These tiny creatures will sometimes do much mischief; but they may always be killed by a slight pinch of the entomological forceps, which every gardener ought to carry in his pocket. The perfect insects are extremely beautiful, their fore wings shining with various colours, and their hind wings being furnished with a long and delicate fringe. In the present species, the fore wings are of a silvery whiteness, with a golden bronze spot near the tip, and several brown bars. The hind wings are silver-white. It is a very little moth, the expanse of wings varying from one sixth to a quarter of an inch.



LILAC-LEAF ROLLER.

THE very pretty CONFLUENT-BARRED MOTH (*Gracillaria syringella*) is most elegant and graceful in its form, and has derived from its shape the appropriate generic title of Gracillaria. The fore wings of this insect are tawny, in which the yellow predominates, and are profusely mottled with brown, and have, near the tip, an eye-like mark with a black centre. The hind-wings are greyish brown.

The larva of this moth is very destructive in gardens, feeding upon the leaves of the lilac, and treating them cruelly. Hundreds of leaves may be seen on a single lilac-tree, all disfigured by being rolled into a rather large cylinder, as is seen in the illustration; the whole of the leaf being curled, and each leaf rolled singly. If these green cylinders be examined, the caterpillar of the Confluent-Barred Moth will be found within—or rather, it will generally not be found within, but without its house, dangling therefrom at the end of a silken thread.

Sometimes the larva may be seen before it takes up the business of leaf-rolling. When first hatched, it burrows into the leaf, and remains between the two membranes, feeding upon the green parenchyma, or soft substance, within. When, however, it has attained sufficient size and strength, it makes its way out of the leaf, leaving behind it a blistered track as a memorial of the former occupant. As, however, the caterpillar always feeds under cover, and has attained dimensions which debar it from residing between the membranes of the leaf, it sets to work to make a new habitation, and does so by rolling the leaf into the form which has just been described.

There are two broods of this moth produced in each season; and as the insect is a very prolific one, the damage which it works is in some years very great. The perfect insect may generally be found in May and June. About twenty species of Gracillaria inhabit this country.

Our last examples of the moths are to be found among those remarkable tribes in which the wings, instead of being four broad, flat membranous organs, are deeply cleft, and very much resemble the sticks of a lady's fan, without the connecting paper or silk. The wings are always deeply feathered, so as to afford the needful resistance to the air; and though the insects are able to move about through the air, their flight is neither swift, strong, nor enduring, but has a feeble, fluttering air about it.

WHITE PLUME MOTH.

The most conspicuous species of the Plume Moths, as these insects are termed, is the White Plume Moth (*Pterophorus pentadactylus*), an insect which may be left undisturbed; for not only is it very beautiful in form, but is rather beneficial than otherwise, while in the larval state, feeding upon the common nettle. This moth is called Pentadactylus, or five-fingered, because the fore wings are cleft into two divisions and the hind wings into three, so that on each side there are five projections in lieu of wings.

The White Plume Moth is mostly seen towards evening, when it flits about as if carried along by the wind, without making any exertion of its own. It is easily seen in the dusk, as its showy white plumage renders it very conspicuous, whether it is flying along, or settled upon some plant and remaining motionless, as is its wont, with its wings partly spread.

Although more plentiful than the White Plume Moth, the COMMON PLUME MOTH (*Pterophorus pterodactylus*), is not so often seen, on account of its duller plumage, which renders it less conspicuous in the hours of dusk, when these moths love to come abroad. The colour of this species is rather variable. The hind wings are brownish, and the fore wings are grey, sometimes tinged with dusky red or brown, and having a dark spot just behind the cleft. The larva of this insect feeds upon the thistle, and is rather a pretty-looking creature, being dark dusky red with white lines.

There are twenty-seven acknowledged British species of this beautiful genus, and none of them seem to be at all injurious to the gardens, the larvæ feeding on nettles, the burdocks, the rest-harrow, and other plants, which are not cultivated in gardens, or are ever extirpated from them as weeds.

Closely allied to the previous species is a beautiful little moth which is even more elegantly and delicately formed. This is the TWENTY-PLUME or SIX-CLEFT MOTH (*Alucita hexadactyla*). The latter name is the more appropriate of the two, because each wing is cleft into six fingers, so that in fact the total number of plumes is twenty-four, and not twenty. Beautiful though the little creature may be, it must yet take rank among our garden foes, inasmuch as the larva feeds upon the honeysuckle. When the caterpillar is about to change into the chrysalis, it opens a nearly transparent silken cocoon, and then undergoes its transformation. Two other species of this genus are said to exist in England, but several entomologists believe that they are merely varieties of the Six-cleft Moth.

CHAPTER XXIV.

THE HOMOPTERA—Distinctive Characteristics of the Order—The CUCKOO-SPIT—Formation of its Frothy Envelop—Development of the Insect—The Tettigoniæ and their Ravages among Plants—The ROSE-HOPPER and its Food—Method of Fumigating Plants in the open Air—The PEAR and APPLE CHERMES—Why so called—Their curious Aspect—The CAMELLIA and FIG CHERMES—APHIDES—Their rapid Development and the Injury which they do to the Plants—Damages to the Hops—How to Destroy them—Their vast Numbers—The AMERICAN BLIGHT—Origin of its Name—Its mischievous Habit—Various Plans for Killing it—Mr. Waterton's System—SCALE Insects and their Ravages—How to Destroy them.

WE now come to a fresh order of insects, called the Homoptera. All these insects may be known by the wings, which are entirely membranous, and bent downwards, the front wings larger than the hinder, but not overlapping in repose. The antennæ are mostly very short, and the organs of the mouth form a kind of short proboscis.

In this group we find some very wonderful insects. Those which inhabit the tropics have a world-wide celebrity, such as the shrill voiced Cicadæ, and the well-known Lantern flies, besides other insects very familiar to entomologists, but not so generally known as they deserve to be, on account of the unique structure of the bodies. The thorax, especially, is moulded into the most astonishing and unexpected jaws, displaying a fertility of invention, and an eccentricity of shape that far surpasses even the efforts of the earlier painters when engaged upon their favourite subjects, St. Anthony surrounded by imps and demons, and succubi armed with mail and weapons as bizarre as the shapes of their wearers.

Our limited space will not permit any detailed account of the strange and interesting creatures to which a passing allusion has just been made, and we must therefore pass at once to a very common and very mischievous insect, the common CUCKOO SPIT, or FROG-HOPPER (*Aphrophora spumaria*). Both the scientific names allude to the peculiarity for which the insect, while in its larval condition, is most conspicuous. The name Aphrophora is composed of two Greek words, signifying foam or froth-bearer, and the word spumaria is Latin, bearing a similar signification.

It is rather a curious fact that the white frothy masses which hang on our trees, and bedew our faces unpleasantly as we walk beneath their shade, or wet our fingers as we endeavour to pluck the leaves or flowers, should be so universally thought to be the saliva of the bird. When I was a very tiny boy, I was sadly scandalized because my nurse told me that the froth was really the substance which is implied by its name. I knew better. I knew that there was abundance of Cuckoo Spit in the garden, and that if we wanted to hear the cuckoo we were obliged to go into the fields.

Moreover, I had many a time poked out the soft grey-green insect from its frothy habitation, and had discovered that in the insect lay the cause of the froth; and, before I was eight years old, I had traced the creature from the larval to the perfect stage, and was afterwards quite surprised to find the whole affair in a real book. There is no such school for practical entomology, or, indeed, for natural history in general, as a tolerably large garden where children may run about as they like, without the fear of being scolded for getting on the flower-beds, or climbing the trees.

Children are very close observers. I now feel quite surprised at the amount of practical knowledge which we gained without the use of books, simply by examining the various creatures that were found in the garden. Snakes, frogs, and toads, were our very good friends; we never feared the contact of harmless insects, and we contrived in some way to trace out for ourselves the transformations of many indigenous insects. We knew, therefore, that the Cuckoo Spit was not produced by the cuckoo, as the English think, nor by a frog, as the French think, and we also knew that neither the bird nor the batrachian was likely to spit at all.

The transformations of this insect are easily watched. The mass of frothy substance, which surrounds it in its first stages, renders its locality very conspicuous, and the creature remains within the froth until it has passed through its preliminary stages of existence. The larva is soft, greenish, with black specks for eyes, and a wonderfully long beak, which is plunged into the plant on which it feeds. There are no wings on the larva. When the creature takes the pupal form, it bears an evident resemblance to the perfect insect, except that its wings are only rudimentary.

At length it throws off its garment for the last time, and emerges into the world a different being. Formerly it was confined to one spot, surrounded thickly with the exudations derived from the juices of the tree, soft, quiescent, and helpless. Now, it is a compact, hard-bodied, active little creature, able to fly through the air, to walk, or to leap, the last-mentioned movement being performed with an agility that has earned for the insect the popular name of Frog-hopper. As children, we used to call it skipjack, in honour of the well-known toy so dear to children, composed of a goose's breastbone, a twisted string, a wooden tongue, and a dab of cobbler's wax. The colour of the Frog-hopper is pale brown. There are two species of this genus in England. There is a much larger Hopper, very plentiful in some places, and called, from its colour, the SCARLET HOPPER (*Cercopis sanguinolenta*), a beautiful creature, scarlet and black in colour, and much larger than the preceding insect.

CLOSELY allied to the cuckoo spit is a small group of insects called TETTIGONIÆ, several of which are found in this country. The colours of these insects are lovely in the extreme, not only for the purity of their hues, but the intensity of their tints. They have some slight resemblance to beetles, the richly-coloured wings looking very like elytra; and it is no uncommon circumstance for a novice in entomology to waste much time and labour in trying to identify a Tettigonia, which he has taken for a beetle, and is attempting to class among the coleoptera.

The larva of the Tettigonia is very injurious to plants, driving its sharp proboscis into the leaves and tender bark, and sucking the juices as greedily as its ally the frog-hopper. Throughout all the transformations, the creature retains a similar form. In its earlier stages, however, it is devoid of the splendid colouring which characterises the perfect insect, and of course the larva is entirely wingless, and the pupa only possesses those organs in a rudimentary condition. These insects are not at all uncommon in this country.

One species belonging to this family has often been placed erroneously among the Psyllidæ, a group of insects which comes next on our list. There are thirty species of this genus, all of which may be distinguished by the absence of the ocelli, *i. e.* the little, simple, supplementary eyes that are placed on various parts of the head. The species which is given in the illustration, namely the Rose-hopper (*Typhlocyba rosæ*) is, as its name imports, a feeder upon the rose-tree, and is often very injurious.

The numbers of these insects, and the close manner in which they cling to the plant from which they derive their sustenance, renders the operation of hand-picking very difficult and uncertain, and the only sure method of destroying them is to attack them *en masse*, either by fumigation or by treating them with tobacco-water; and if the trees are trained against walls, the best plan of fumigating them is as follows:—

Nail a piece of old carpet above the trees, and fasten the sides around the tree, leaving only the bottom loose. Have ready some touch-paper, *i. e.* brown paper that has been soaked in a solution of nitre, and make it up into a squib-like form. Fill it lightly with tobacco, and twist a piece of stout wire round it, so as to make a handle whereby it can be held above the surface of the ground. Stick the wire in the ground so that the prepared squib is held under the carpeting and away from the tree; light one end of the squib, and then leave the whole affair to its own devices. In a few moments the tobacco will be lighted, and, aided by the touch-paper with which it is surrounded, will smoulder to the very end, and surround the affected plants with a suffocating smoke that is fatal to insect constitutions. The insect-powder already mentioned can be substituted for the tobacco, and in greenhouses is certainly preferable, especially where these edifices are frequented by ladies, who seem to dislike the smoke as much as do the insects.

THE Psyllidæ are insects which are terribly destructive to gardens, and are popularly known by the name of Chermes. Sometimes they are mistaken for their near allies, the aphides, or plant-lice, by non-entomological gardeners, on account of their small dimensions and general shape.

Our first example, the PEAR CHERMES (*Psylla pyri*), infests the pear-tree in vast numbers. It is rather a pretty-looking creature, with orange-yellow head and throat, a green abdomen, and beautiful milky white wings.

The female Chermes lays her eggs on various parts of the tree, such as the young twigs, the blossoms, or even the fruit. These eggs are yellow and very minute, and are placed in such numbers that they look as if a stamen of some flower had fallen on the spot and left some of its yellow pollen behind. The young increase rapidly in size, darkening in their tints as they grow, and when they have attained the proper age, they crawl slowly about the tree until they come to the young shoots, into which they plunge their beaks, and on which they remain until they are called upon to assume a more perfect state.

They then leave the twig on which they were feeding, and fix themselves securely to a leaf. In a short time the skin splits along the back, and from it emerges the perfect Chermes, as yet soft, and of a delicate green, and with wings looking merely like crumpled folds of wet silver paper. In a day or two, however, the green upon the head and thorax changes to its orange hue.

ANOTHER species of this genus, the APPLE CHERMES (*Psylla mali*), is as mischievous among the apples as the preceding insect among the pears, though its depredations are not carried on in precisely the same manner.

The larvæ of the Apple Chermes prefer the buds, and as soon as they are hatched they proceed to the young buds and feed upon their juices. The larva of this species, in common with several others, is enveloped in a white cottony mass, which is evidently analogous to the froth in which the larva of the frog-hopper resides. This mass is composed of a vast number of delicate white filaments, which exude from the body, and assume various forms in different species. The perfect insect is a very pretty creature, of a delicate light green, marked on the abdomen with yellow rings, and the membranous wings being traversed by strong snowy white nervures. The empty skins of the pupæ can be found abundantly on the trees, their dry and shrivelled limbs still clinging to the trees, as if life were not utterly extinct. The cast skins of the common may-fly and of the dragon-fly may in like manner be discovered upon the plants and trees growing near the water-side.

One species of Psylla is peculiarly obnoxious to florists, because it enters the greenhouse and takes possession of the most valued plants. This is the *Psylla cratægi*, an insect which, for want of a better name, we may call the CAMELLIA CHERMES, because it is so frequently found upon that beautiful flower.

All who have the least acquaintance with floriculture are aware of the trouble which is taken to rear the perfect flower of the camellia; how the plants have to be grafted, or inarched; to be potted and re-potted, and treated with hotbeds, and supplied with moist air, and put out in the shade and sheltered from the sun and petted and indulged as if the whole universe depended on getting the petals properly rounded and quite regular. Now, the least interference with the proper growth of the shrub will mar this consummation. A little too much heat, or air, or moisture will spoil the flower, and a trifle too little will have the same effect. Insects of various kinds, such as the aphis, the scale, the Chermes, are very fond of the camellia, and if permitted to make a settlement, will divert the juices of the plant and stunt the growth of the blossoms.

It must always be remembered that when insects are to be destroyed by smoking, half measures are useless. They must be enveloped in a dense mass of smoke, and forced to remain in it until they are dead. Smoke that merely sweeps over them, and then passes away, is quite useless, and the notion of bringing pipes and cigars into the greenhouse, and hoping thereby to combine business with pleasure, is entirely fallacious. And if this be the case in an inclosed building, *à fortiori* is it useless to attempt the dislodgment of noxious insects in the open air.

You may puff as much smoke as you like over a branch infested with aphides, and you will produce scarcely any effect except a general movement among the green hosts that cluster round the branch; but put a paper cap over the same branch, place the mouthpiece of the pipe under the paper, and blow through the bowl, so as to fill the paper with smoke, and by the time that the smoke has been totally dissipated the insects will be dead. The strongest and coarsest tobacco should be used for such purposes, such as can be procured at the cigar manufactories for a sum little exceeding the duty.

Our last example of the Psyllidæ is the FIG CHERMES (*Psylla* [or *Anisotropha*] *fici*), an insect of which we need say nothing but that the fig-tree is peculiarly liable to its ravages. In habits it much resembles the preceding species. About twenty-seven species of Psylla are known to reside in England.

ANOTHER large family of this order now comes before us. Every one knows the Aphides, or Plant-lice, or Green Blight, as they are indifferently called. The last-mentioned term, indeed, is a great favourite with gardeners, who apply it indiscriminately to fungi, insects, and adverse winds. In their vocabulary, everything which destroys on a large scale is a blight; and I have no doubt that if the migratory locust were to make its incursions into this country, that insect would likewise be ranked among the blights.

They bear rather a close resemblance to the Psyllidæ, but may be distinguished from those insects by the structure of their antennæ, which have only seven joints, whereas those of the Psyllidæ are ten-jointed.

There is an allied family called the Aleyrodidæ, the members of which are very Aphis-like in appearance, but may be identified by the comparative absence of nervures in the wings, there being only a single nervure running along the centre of the fore-wings. These insects are very minute, but from their number are often very injurious to the oak, the cabbage, and other leaves, on which they may be found, looking like flat patches of grey, powdery substance, in which may be seen some tiny living creatures slowly moving about. They mostly congregate on the undersides of the leaves.

To return to our Aphides.

It is well known that these insects are prolific to a degree almost unexampled, and that their economy presents one of the most singular and most incomprehensible spectacles in Natural History. Much is known of these creatures, and much remains to be learned. We know already that generation after generation will be produced, all females, and all capable of reproducing offspring, which in their turn will be born in a condition preparatory to parentage. We know that nine successive generations of Aphides have been produced all females, and without the presence of a single male.

The rapidity of their increase will account for the vast multitudes which are found upon certain plants. Take, for example, the ROSE APHIS (*Aphis rosæ*), and see how the little green creatures cluster around the twigs and buds of the tree, packed so closely together that not a particle of the shoot is visible, and apparently increasing in numbers daily. There they cling, their little legs holding tightly to the shoot, and their long beaks driven deeply into its soft substance, draining the juice that ought to assist in the growth of the plant. Not only do the Aphides injure the plant by sucking its juice, but they distort it in various ways. By means of their slender beaks, each so small as to appear harmless, the leaf-stems are covered with unsightly knobs and excrescences, twigs are bent aside, and even the branches of forest trees suffer sadly in form, having been distorted while young by the Aphides, and never being able to recover their figure. I have in my possession several specimens of damaged leaves and twigs, some of which are positively contorted until they look as if they had been twisted by the hand of man, and intended to imitate corkscrews.

The hop is especially liable to the attacks of Aphides, which, in the popular language of the districts where that valuable plant is grown, are dignified by the name of THE FLY. Many a fine promising harvest of hops is marred, or even destroyed, by the countless hosts of Aphides, which are produced so rapidly that the hop-growers can hardly be made to believe that they are produced after the course of nature. There is an excellent note on this subject in Kirby and Spence, Seventh Edition, page 100.

After mentioning that the Fly sometimes makes a difference of 200,000*l.* in the duty paid on hops, the writer proceeds as follows: "It would not be difficult to show that nearly the whole of this large sum, and their own still greater losses, are thrown away by the hop-planters from their ignorance of entomology. Led by their old prejudices of the fly being produced by cold winds, &c., they do nothing towards its destruction, though, if aware of the way in which it is generated, and that by killing each female as it appears early in the spring, they would prevent the birth, not of thousands, but of millions of Aphides; were they to take measures for thus lessening the number of their destructive enemy, they might, in great measure, secure themselves from its attacks.

The Aphides, being so soft, are killed with the slightest pressure; so that it is merely necessary to rub an infested leaf between the thumb and fingers, with a force quite insufficient to injure its texture, to destroy every Aphis upon it; and, from experiments which I myself made in the hop-grounds of Worcestershire, when at Malvern in 1838, I am persuaded that every leaf of each hop-plant might thus be cleared of the female Aphides, just attacking it in spring, by women or children mounted on step-ladders for this purpose, in ten minutes, or less. So that, six plants being cleared per hour, sixty might be cleared per day, at an expense of a shilling for labour and the first cost of a few step-ladders; and by repeating the operation every week or fortnight, there can be no doubt that a hop-plantation might be effectually preserved from the fly."

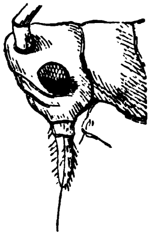
This pest of our gardens can be destroyed in many ways. There is a kind of hand-picking, which is performed by means of a peculiar double brush, made so that the leaves and twigs are grasped between the brushes, and swept clean. Tobacco-water is fatal to them; and when they have attacked a large space, they can be fumigated by throwing sheets over the trees, and pouring volumes of smoke into the extemporized tent.

A very simple method of producing a large quantity of smoke is by fixing a perforated cap at the snout of a common circular bellows, having previously put a quantity of tobacco into the cap, and a small knob of lighted charcoal upon the tobacco. Under these circumstances, the tobacco ignites so readily that the handle of the bellows must be turned very cautiously, so as to prevent flames bursting forth—an event which is always to be deprecated, as the fumes injure the plants as much as the Aphides. Moreover, if the blast be too fierce, and the cap not very well made, the solder is apt to be melted, and then off falls the cap, with its contents.

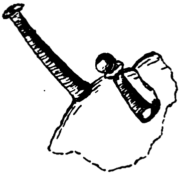
I write from experience, having once performed a similar feat when smoking a hive with puff-ball. Fortunately, the bees were half-stupefied, or I might have suffered for my awkwardness. Some who read these lines will well remember the event, and the triumphant exultation of the old gardener, who always "burnt" his bees, and laughed to scorn our new-fangled ways.

Windy days ought never to be employed while "smoking" plants that are in the open air. To retain the smoke is an impossibility, for the wind insinuates itself in a most provoking manner, and you have the mortification of seeing the smoke escape in all directions, and waste its fragrance on the careless breeze. The tobacco-water should be applied with great care, so as to avoid waste. In the case of large trees, the only method is to force it through a garden-pump with a fine rose, so as to make it fall in a fine shower. But upon plants and shrubs that can be reached by the hand, there is no plan so good as taking a syringe with a fine mouthpiece—the glass syringe described on page 216 will answer the purpose admirably—filling it with the potent fluid, and allowing a drop or two to fall upon each infected branch. Care should be taken to pour the liquid upon the uppermost insects, so that it may percolate through the mass, and poison each individual.

On the leaves of trees which are much infested by the Aphides may be observed a glutinous substance that adheres to the fingers like glue, and is very sweet to the taste. This substance is popularly called "honey-dew," and is secreted from the Aphides, just as the froth is produced by the frog-hopper. It exudes from the little projection over the tip of the abdomen, which is very evident under the microscope; and if an Aphis in full health be submitted to the instrument, the little drops of sweet substance may be seen protruding from their extremities. Bees and ants are very fond of the honey-dew. The bees may be seen by thousands sweeping it from the leaves on which it has fallen; while the ants prefer to approach the fountain-head at once, and sip the saccharine secretion as it exudes from the insects. Thousands of ants may be seen traversing the trees on which the Aphides are plentiful, and not attempting to seize or kill the Aphides, but taking the sweet exudation as it pours from the natural conduits.



HEAD OF APHIS.



PAPS OF APHIS.

The head of the Aphis is worth a careful examination. The eye is very beautiful, and the proboscis is a wonderful instrument, that deserves a careful investigation.

In some years the Aphides are far more numerous than in others. They have been known to rise in the air in such astonishing multitudes, that, as they were blown about at the mercy of the wind, their vast armies filled the streets, and passengers could not walk about with any comfort, unless their faces were protected with veils from the masses of these small insects. And yet, as not a tenth part of their number ever attain the winged state, it may well be imagined that they must have left behind them reserves far more formidable than the main body, and that if the observer could only have followed their track, he would have found on the spot wherefrom they started, vast multitudes that would have made the winged detachments appear comparatively insignificant.

These great invasions are always periodical, and always connected with a strong wind; the reason being, that the insects are not strong enough to bear up against the wind, and are therefore obliged to follow the course of the tempest. As the greater number of the hop-bearing counties are towards the south-east of England, it is evident that an eastern or southern wind would carry the insects inland, whereas a western or northern breeze would hurl them into the sea, and they would no more be seen, just as often happens with the locust-clouds that ravage so many countries.

The habits of the various species of Aphis are so similar, that there is no necessity for describing them separately. Suffice it to say, that the three species which are given as illustrations of this destructive genus are mostly found on different plants—*Aphis rosæ* feeding upon the rose; *Aphis ulmaria*, upon the pea; and *Aphis rumicis*, upon the bean. Still, though certain species of Aphis frequent one plant in preference to another, they are not restricted to one kind of diet, and may be found on various plants and trees.

Fortunately for the gardener, the Aphis has many insect enemies, most of which are described and figured in this work, because they deserve protection at our hands, in exchange for the excellent service which they render.

Many little ichneumons lay their eggs in the Aphis, causing it to leave its companions, to swell up, and die. In a short time a little round hole is opened in the distended skin, and out comes the hidden parasite, which has undergone its transformation while within the Aphis. Some insects eat the Aphides; some provision their nests with them; and others, while in the larval state, feed entirely on these little green pests.

SOME years ago—how many is not known—a new kind of garden foe was imported from abroad, and has settled itself here in force.

It is acknowledged by all practical entomologists, that many of the group of insects which we know by the name of Scale

Insects, Mealy Bugs, American Blight, Apple Blight, and other titles, are not indigenous to England, but have been brought over from a foreign country, probably upon some living plant, from which they had not been extirpated before removal. Since that time, the Scale Insects have spread themselves over the land, and the mischief which they occasion ought to be a lesson to botanists of future ages. It is a useful task to import a new plant into this country, but if, at the same time, we import the insect which not only feeds upon it, but can live upon our native plants, and is, at the same time, exceedingly prolific, the benefit is rather questionable.

There are now in England several species of the Coccidæ, as these insects are called, some of which are mostly confined to greenhouse and hothouse, while others prefer the open air, and brave unhurt our severest winters, neither frost nor snow nor ice seeming to affect these tiny, but hardy little beings.

The commonest of these garden pests is the AMERICAN BLIGHT (*Coccus* [or *Pseudococcus*] *Adonidum*), so called because it was supposed to have been originally brought over from America. It may be seen chiefly upon the apple and pear trees, and in some places is so numerous, that the trees are almost enveloped in the white cottony masses, and look, at a little distance, as if they had been under the hand of the whitewasher.

In many parts of England, especially those in which cider forms a staple commodity, and orchards are necessarily cultivated to a great extent, the American Blight inflicts serious injury upon the agriculturist, its vast numbers rendering it most formidable, in spite of its minute dimensions.

If we remove a patch of the white down from the branch, examine the tiny insects which reside within it, and compare their soft, small delicate bodies with the amount of damage which they occasion, we can but wonder at the disproportion of the effect to the cause. On looking at an isolated specimen of this insect, it seems really wonderful that so tiny a creature should be able to procure food from the rough bark of the tree, and that it should possess an organ of suction strong enough to penetrate the bark. Such, however, is the case, for the insects are furnished with a little, but comparatively long proboscis, which in some strange way, is insinuated into the bark, and enables th insect to reach the juices. When not in use, the proboscis lie along the under side of the body, and even projects beyond the tip of the abdomen.

The thick, cotton-like exudation evidently serves the purpose of a defence, and also is a means whereby the insects are transferred from one plant to another.

During the winter time, the insects seek the crevices of the rough bark, their minute size enabling them to creep into the smallest imaginable recesses, and there they lie until the following spring drives fresh sap through the branches, and renders them fit to supply nourishment to the tiny parasites.

Various methods of killing these parasites have been proposed. Some gardeners cover their trees with whitewash, a plan which may certainly prevent the white flocculent masses from being so conspicuous as they would be, if they stood out in bold contrast to the bare bark of the trees, but has but little effect in killing the insects. Indeed, it seems rather bad policy to enable your enemies to conceal themselves, and to hide the mischief which they are doing until the damage has gone too far for repair.

Scraping off the rough bark in the late autumn, burning it, and scrubbing the trees with a hard brush, is a favourite and partially effective remedy with some persons. Still, the insects are so tiny, and the crevices into which they creep are so very small, that thousands of them may lie concealed in places which the brush cannot reach, and will, in consequence, survive until the succeeding year.

Various mixtures have been employed, which are used by plastering them upon the bark and working the brush well into the crevices. One of these mixtures is composed of equal parts of resin and fish-oil melted together, and applied while hot. Another remedy is compounded of soft soap, sulphur, tobacco and spirits of turpentine. A very simple and effectual remedy has been long employed by Mr. Waterton, and its potency tested by the experience of years. The following is his description of the remedy, and the mode of its application :—

" Long ago I turned my thoughts to the extermination of the spoliator, which had nearly rendered the choicest parts of the orchard a sickly, sad, unprofitable waste.

I began by trying to make the branches, upon which these diminutive harpies had settled, as disagreeable to them as it were possible, hoping by this manœuvre to starve them out of house and home. With this in view, I applied unctuous preparations to the injured parts of the trees; but finding, in the long run, that this availed me nothing, I made a decoction from walnut leaves, and washed the branches well with it, calculating that the bitterness of the decoction would render the favourite food of the insects unpalatable to them. But I was deceived; the bugs continued their depredations as though no pains had been taken to dislodge them.

The application of spirits of turpentine killed them at once; and for a few days after it had been applied I was in hopes that their extermination had been effected, but others soon appeared. Despairing of success, I was on the point of quitting the field, and leaving the bugs in undisturbed possession of it, when I began to conjecture that I had not gone the right way to work. I reflected that none of my applications could have penetrated sufficiently deep into the curved and knotty sinuosities of the diseased parts, and that, on this account, there would be a sufficient force of the enemy left alive to recommence its depredations at the first favourable opportunity. Wherefore I concluded that nothing short of the entire destruction of the eggs, the young, and the adult, could save the trees from ultimate ruin. Knowing that the bug could not exist if totally deprived of air, I resolved to bury it alive; and this I effected by an application at once the most easy and simple that can be imagined. It costs nothing.

I mixed clay with water till it was of such a consistency that it could be put on to the injured parts of the tree, either with a mason's trowel or with a painter's brush. I then applied it to the diseased places of the tree, and it soon smothered every bug. A second coat upon the first filled up every crack which showed itself when the clay had become dry, and this resisted for a sufficient length of time the effects both of sun and rain. The sickly parts, now effectually freed from the enemy which had been preying on their vitals, were placed in a state to be cured by the healing process of Nature; and that Nature has done her duty, my apple-trees amply testify.

Probably this nostrum is too simple, and not sufficiently costly, for me to expect that it will attract much notice. Still, I think there is no harm in committing it to paper. It may yet prove the best friend to the cultivator of apples, when all his more scientific and expensive resources shall have failed in their effect."

IN hothouses and greenhouses, the TURTLE SCALE INSECT (*Lecamium testudo*) is very plentiful, and is a sad pest to the gardener. The female of this curious insect looks just like a very small and very flat limpet stuck upon the leaf; and when she has reached maturity is perfectly quiescent, being fixed to the leaf as firmly as if she formed a part of its structure.

It has been well observed that this insect is extremely valuable to physiologists, as showing that, even among the annulate animals, there are some which assume a less perfect form when they attain maturity, the adult female Turtle-Scale being motionless and apparently senseless, while in its earlier stages it was active and tolerably lively. The reader will probably remember that the barnacles are governed by a similar law, roaming the sea at will while in their larval condition, but losing their limbs and their eyes, and becoming fixed to the rocks when they have attained their full development.

The male of this insect is a tiny creature, very much smaller than its mate, and is furnished with a pair of beautiful wings, which lie nearly flat, and cross each other in repose. He is very active, and can run, as well as fly, with tolerable speed, forming a singular contrast to his enormous and lethargic mate. Perhaps the doctrine of contrasts holds good, and he may possibly value his mate because she is so completely unlike himself.

The only sure method of ridding the plant of this pest is by hand-picking. The scale-like bodies of the female insect can be easily removed by the fingers, and from the male alone there is nothing to fear. Still, he will fall a victim to tobacco-smoke, and no harm will be done if fumigation as well as hand-picking be employed. The insects belonging to this genus can easily be recognised by the peculiar form of the female, which is flat and scale-like, and has two fine threads protruding from the end of the body. The male is very much smaller, and winged.

The VINE SCALE (*Lecamium vitis*) is terribly destructive to the grape-vine, restricting itself, however, to those plants which are cultivated in the greenhouse. In warmer countries, this species attacks in preference the vines that grow in the open air; but in England it is not able to endure our climate, and is forced to content itself with those vines which are grown within houses.

The adult female of the Grape Scale insect is fixed to the branches on which she resides, her legs being at last quite useless, and absorbed, as it were, in the substance of her body. A vast amount of white woollen substance is poured out from her body, and serves as a protection for the eggs and the young during their earliest stage of existence.

The ORANGE SCALE (*Lecamium hesperidum*), infests green leaves, and feeds chiefly on the orange-tree. The specific title, Hesperidum, is given to it in allusion to the garden of the Hesperides, whose golden apples play such a conspicuous part in classical mythology, because the ruddy golden colour of the ripening orange is thought by some scholars to have been the original idea in which the fable originated. For, though America and the West Indian islands seem to have been unknown to the ancients, several of their vegetable productions were certainly familiar to the wealthy, and it is not unlikely that the orange fruit may have fallen into the hands of adventurous sailors.

Another species, the PINEAPPLE SCALE (*Aspidiotus bromeliæ*), feeds chiefly upon the regal fruit from which it derives its popular name, but is also found on several other plants, such as the various mallows (*Hibiscus*) and the different species of justicia. The PEAR OYSTER-SCALE (*Aspidiotus ostrææformis*) is found upon the pear-tree, and certainly does bear some slight resemblance to the mollusc after which it has been named.

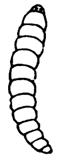
CHAPTER XXV.

DIPTERA—Characteristics of the Order—The EMPIS—Its Appearance and Services—The HAWK-FLY—The DRONE-FLY—Its curious Larva and Development—The VOLUCELLÆ and their Parasitical Habits—The NARCISSUS-FLY—Its Larva and Food—Best Method of checking its Ravages—The TACHINA—Its Appearance and remarkable Habits—The ONION-FLY and its Depredations—How to detect and destroy the Grubs—The CABBAGE and LETTUCE FLIES and their Habits—The CHERRY-FLY—The ROSE-FLY and PHORA—The WHEAT-FLY and its Ravages—ST. MARK'S-FLY—The Voracity of its Larva, and best Mode of destroying it—The PEAR-MIDGE—The CRANE-FLIES—The Food and Development of their Larvæ—The CELERY-FLY and its Allies—Their Habits, Depredations, and Development.

OUR fast-waning space warns us that we must content ourselves with very brief notices of the creatures which yet remain to be described.

We now pass to that enormous order scientifically called the DIPTERA, or Two-winged Insects, and popularly known by the name of Flies. They may be always recognised by their two wings, which cannot be folded and are always membranous, and by the little club-like "balancers" behind the wings, which are, in fact, the representatives of the second pair of those organs. They all live by suction, and many of them possess formidable lancets, by means of which they can pierce their prey and set flowing the liquids on which they feed.

OUR first example of the Diptera belongs to a most useful genus of flies, called the Empidæ. Very little is known of the larval condition of these insects, but they are certainly harmless in their preparatory stages. The perfect flies are exceedingly voracious, chasing other insects in the air, or picking them off their perches, with wonderful assiduity and skill. Their legs are long, and formed so as to clasp the prey in their embrace; and when an unfortunate victim is once seized, it never escapes. The long legs close tightly round the body, binding together legs and wings so as to prevent all struggling, and the sharp beak with which the mouth is armed is thrust deeply into the body.



EMPIS TESSELATA.
(Larva.)

The Empis seizes insects of various kinds, but is especially useful to the gardener because it is so fond of the leaf-roller moths, destroying thousands daily. Indeed, at some periods of the year, it is hardly possible to catch an Empis which is not carrying some moth or fly in its fatal grasp. There is a general similitude about the Empidæ which renders them impossible to be mistaken, and the gardener will do well to protect these useful flies by all possible means.

In another family of flies, the Syrphidæ, or Hawk-flies, the benefits conferred upon the gardener are not always of so unmixed a nature; for in some species, although the perfect fly does certainly assist the gardener by killing noxious insects, it also enacts the part of a noxious insect while in its preparatory stages of existence, sometimes feeding upon valuable plants and flowers. Such a creature is the Striped Onion-fly (*Eumerus striatus*). The larva of this insect feeds upon the onion and the carrot, and is brownish in colour, and rough to the touch, on account of the multitudinous bristles which cover the surface, and are planted most thickly towards the extremity of the body.

STRIPED ONION-FLY.

Another common species is the Drone-fly (*Eristalis tenax*), so called because it bears a very close resemblance to a drone bee, as it sits on the leaves, lazily enjoying the sunshine. So close, indeed, is the similitude, that few persons will venture to touch the insect, mistaking it for a veritable bee. The specific title of *tenax* is given to this fly on account of the tenacity with which it grasps the object on which it places its feet.

The larva of this fly is a very useful one, as it lives amid decomposing mud, and aids in destroying the noxious substance which gives rise to malaria and its accompanying ailments. The larva is popularly called the Rat-tailed Maggot, because it possesses a long telescopic tube, which proceeds from the extremity of its body, and enables it to breathe atmospheric air while the body is deeply sunk in the mud. If the observer will go very quietly to any spot where leaves and other vegetable substances have been decomposed into wet, soft mud, and will examine the surface, he will see a number of little thread-like projections, which will be withdrawn as soon as a heavy footstep communicates a shock to the surrounding earth. These are tubes of the Rat-tailed Maggot; and if the creatures be removed, washed, and put into a vial of clean water, their beautiful structure can be easily made out by means of a magnifying-glass.

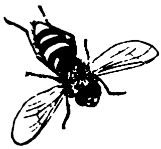
PASS we now to the curious VOLUCELLA flies, of which a great number of species inhabit England. These insects are mostly of beautiful colours, and many of them are strangely like bees, wasps, and other hymenopterous insects. The larvæ of these remarkable flies are mostly carnivorous, and feed upon the grubs of various hymenoptera, residing in their nests, and seeming to be quite unnoticed by the formidable insects on whose offspring they subsist. Some live in wasps' nests, and others among the cells of the humble bees; and it is seldom that a nest of either insect can be thoroughly investigated without the discovery of some Volucella larvæ in the interior.

It is generally supposed that the singular resemblance of the perfect insect to the object of its attacks is for the purpose of permitting it to enter and leave the nest undiscovered. Certain it is that the HUMBLE-BEE VOLUCELLA (*Volucella bombylans*) is so exactly similar both in shape and colour to the common humble bee, that it might pass muster among the rightful inhabitants of the nest without being discovered. I have often found these larvæ within the nest—large, white, fat-bodied grubs, pointed at one end and very thick at the other, the larger end looking as if it had been abruptly cut off with a knife, and having a radiating circle of points round its edge, something like a dog's spiked collar.

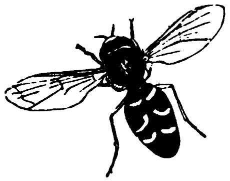
Of the genus Scæva we have many British species, from which we select two of the most important examples.

These are most useful insects to the gardener, rivalling the ladybirds in the destruction which they work among the aphides. If the gardener looks carefully at any plant, such as the hop, the cabbage, the rose, &c. which is much infested with aphides, he will see a rather fat, fleshy, green maggot, which is not very conspicuous on account of its colour, which harmonizes with that of the leaves and of the destructive insects which cluster upon them. This is the larva of the Hawk-fly, and ought to be carefully guarded, as it feeds wholly on aphides and makes extraordinary havoc among them.

Placed by maternal instinct in the very midst of its food, it makes the very best use of its opportunities and devours unceasingly. It has a very leech-like look, and moves in a leech-like manner. Fixing itself to the leaf by its broad extremity, it protrudes the proboscis-like head, and picks up the unresisting aphides with wonderful celerity, eating them even faster than they can be produced—a task of no mean severity, when we consider the strange customs of the aphides and the almost fabulous rapidity of their reproduction. There are several species of English Hawk-flies, but the two that are here figured are the most common. The larva of the Hawk-fly lives about ten days in its preliminary condition, and even in that



SCÆVA RIBESII.



SCÆVA PYRASTRI.

short space of time contrives to destroy a very large amount of plant-lice.

There are few rules without exceptions. As a general rule, the Syrphidæ are useful to the gardener, but the **Narcissus-fly** (*Merodon clavipes*) forms a notable exception to the rule.

MERODON CLAVIPES.

The larva of this fly feeds upon the bulbs of the narcissus and daffodil, burying itself in their interior, devouring their substance, and invariably causing them to rot. As may be seen by reference to the illustration, the larva is not unlike that of the common flesh-fly, or "gentle," as it is called by anglers, and is always surrounded by a slimy substance, which exudes from its body and causes the interior of the bulb to decay. When the larvæ have reached their full growth, they gnaw their way out of the bulb, and hide themselves in the earth, where they change into the pupal condition, and there lie until the following spring.

When, therefore, the bulbs are taken up in the autumn, the surrounding earth should be carefully examined, and the pupæ collected and destroyed. They are conspicuous-looking objects, brown, oval, and wrinkled. All bulbs, too, should be scrutinized, and those which have holes in them should be burned. The perfect insects of this genus are not unlike humble bees in their colouring, their bodies being decorated with black, yellow, and orange hues. They make their appearance in April.

The remarkable flies that are placed in the genus Tachina are extremely useful to the gardener, inasmuch as their larvæ are parasitic upon insects which are acknowledged to be the foes of our gardens. Many caterpillars are attacked by the Tachinæ, and afford nutriment to the parasites just as if they had been pierced by the well-known ichneumon flies. The larva of the death's-head moth seems to suffer sadly from these insects, no less than eighty Tachina larvæ having been removed from the body of a single caterpillar.

TACHINA VULPINA.
(Larva.)

Not only do the lepidoptera suffer from the Tachini, but other orders of insects are liable to the same attacks. The common green tortoise-beetle (*Cassida viridis*), which has already been mentioned in this work, has been known to harbour in its interior the destroying larva of a Tachina; and weevils—perhaps the most destructive group among the beetles—have been seen to fall victims to these flies. Various hymenoptera, too, are subjected to the inroads of the Tachinæ, which endeavour to lay their eggs in the nest of the bee or wasp, so that their larvæ may feed upon the rightful owner.

Even the great ground beetles (*Carabi*) sometimes perish through these insidious flies. Spiders of different kinds are devoured by the Tachina; and that destructive saw-fly that feeds on the gooseberries is checked in its depredations by certain species belonging to this strange group of Diptera. Sometimes, as if by poetical justice—which is the truest justice that ever has been vouchsafed to earth—the parasitic larva of the Tachina is itself devoured by another parasite, and a single larva will furnish subsistence to a great number of individuals of the cuckoo-flies.

WE now pass to another fly, which is one of the worst foes with which the gardener has to contend. It does no particular harm among the flowers, but in the kitchen-garden it is peculiarly injurious. This is the ONION-FLY (*Anthomyia ceparum*), an insect which, as may be conjectured from its popular title, feeds upon the onion.

In its perfect state this fly is quite harmless, but in its larval condition it is a sad destroyer of the turnip. As the grub burrows into the very middle of the bulb, and feeds on its heart, there is no method of saving a plant which has once been attacked by it; and the only plan to be pursued is, to gather and burn all the infected and drooping bulbs. The presence of the Onion grub may easily be known by the yellow colour of the shoots and their prone condition, so unlike the vivid green, and bold, stiff uprightness of the healthy plant. Sometimes the grub escapes notice until the onion is stored for winter use; but even in that case, the decaying condition of the bulb betrays the presence of the intruder. All those onions which are not used in the winter, and display the least sign of decay, should be carefully gathered and burned before the warm breath of spring calls forth their inmates to renew the work of destruction.

There are several broods in the year, and the grubs belonging to the latest brood are those which survive the winter, passing the cold months in the pupal condition. The parent insect lays her eggs between the leaf-sheaths of the plant, close to the ground, so that the young grubs may have no difficulty in penetrating into the bulb. As all bulbs are, in fact, subterranean buds, and the grub feeds upon their hearts, the destruction of the plant is a necessary consequence of its presence.

The colour of the insect is pale ashen grey, and the male may be known by the black stripe down the abdomen. The wings are colourless, but possess the usual iridescence of membranous wings.

One or two allied species ought to be mentioned. There is the Cabbage-fly (*Anthomyia brassicæ*), an insect which is nearly as destructive among cabbages as the preceding creature among onions. The grub of this fly feeds both on the root and the base of the stem, and is so effectual a destroyer, that whole fields of cabbages have been killed solely through the effects of this insect. As with the onion, the cabbage betrays the presence of the insidious foe by the yellow drooping leaves, and ought, in that case, to be carefully examined and the concealed insect destroyed. If, however, the plant should be very yellow and very drooping, the best plan is to take it up and burn it.

The colour of the Cabbage-fly is dark but shining grey, and there are three black stripes on the thorax and one along the centre of the abdomen. The wings are transparent, but with a peculiar look, as if they had been slightly smoked. As is the case with most of the dipterous insects, the eyes of the male are much larger than those of the female, and divided from each other by only a slight bar across the top of the head.

Another allied species is the LETTUCE-FLY (*Anthomyia lactucæ*), the larvæ of which reside in the lettuce, and are extremely injurious to that pleasantly narcotic vegetable. As with the other species of this annoying genus, the larvæ mostly quit the leaves and retire into the ground for the purpose of changing into the pupal condition.

In common with most of the dipterous insects, the skin of the larva becomes wrinkled, shrivelled, and contracted, and forms the outer case in which the inclosed insect can peaceably undergo its last and most wonderful change. If such a pupa be opened, it will be seen to consist of a rather stout and horny case, filled with a thick white liquid, in which may be seen very indistinctly the soft and imperfect limbs of the future insect. By boiling, however, or by immersion in spirits of wine, the interior becomes sufficiently hardened for the dissector.

Generally, the grub retires into the earth for the purpose of undergoing its transformation, and therefore a vast number of the pupæ may be collected by scraping up the soil around the plants, and carefully searching for the oval, red-brown objects in which reside the future generation of flies. In some parts of England these pupa-cases are popularly called "shucks." The colour of the perfect Lettuce-fly is greyish yellow, and the head is rather pointed.

The cherry-tree has, perhaps, fewer insect enemies than many other valuable garden fruit-trees; but it is occasionally visited by the CHERRY-FLY (*Ortalis cerasi*), the larva of which insect feeds upon the soft pulpy matter of the fruit. In this country it is scarcely plentiful enough to do very much harm; but as it occasionally makes its appearance in some force, it is inserted among those insects of which the gardener must beware. In the warmer parts of the Continent, where the olive-tree flourishes, an allied

CHERRY-FLY.

species sometimes occasions great loss to the proprietors, the larva beginning its destructive existence by devouring the young leaves, and then turning its attention to the fruit.

I FIND myself obliged to compress notices of several species into a small compass. The larva of the ROSE-FLY (*Trypetra continua*) is injurious to the beautiful shrub from which it derives its name, burrowing into the berry, and so destroying the seed; and the grub of *Psila Rosæ* not only devours the rose, but resides also in the carrot, devouring the root and being extremely mischievous.

ROSE-FLY.

PSILA ROSÆ.

Another genus of this enormous family (the Muscidæ) is termed *Phora*, and may be known by the fringed edges of the wings and the form of the antennæ, which have the third joint quite spherical. There are about thirty British species of this genus.

PHORA ATRA.

The members of this little group of insects hold an intermediate position in our esteem. Some are extremely useful, their larvæ feeding upon the destructive insects, such as the great hawk-moth caterpillars; others may be considered as neutral, the grubs living upon decaying substances; while others are decidedly injurious, deriving their subsistence from garden herbs, such as the radish. The insects belonging to this genus are prettily shaped, their bodies being boldly and yet delicately cut, and their outlines beautifully curved. Their shape rather reminds the observer of that of the sand-wasp.

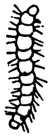
THERE is a terribly destructive insect that is often mistaken for a gnat, but which really belongs to a separate family of Diptera. This is the WHEAT-FLY (*Cecidomyia tritici*), a creature which sometimes works great devastation in the corn-field. The eggs of this insect are deposited by the mother in the middle of the flower, and when hatched the little grub feeds upon the pollen, thereby checking, not so much the growth of the individual plant on which it resides, as its future development and spread.

WHEAT-FLY. (Larva.)

The now celebrated Hessian-fly belongs to this genus. This terrible pest is greatly dreaded in North America, where it lays waste whole fields at a time. It does not eat the pollen, but bores into the stem, and so destroys the plant. In some seasons these insects assemble in countless multitudes, traversing over vast districts, but taking very short journeys, and passing only about seven or eight miles per annum.

Whatever may be the species of this genus, the larva is seldom seen, hiding itself within the plant on which it feeds, and almost invariably residing within a kind of gall, very much like that which is produced by the various Cynipidæ. They are all very tiny insects, but their vast numbers more than compensate for their minute dimensions. The antennæ of the Wheat-flies are always composed of many joints, and their wings are remarkable for the almost entire absence of veinings.

NEXT on our list comes the insect called by gardeners ST. MARK'S-FLY (*Bibio Marci*).

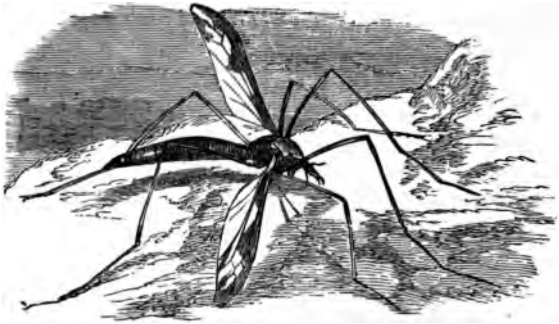

BIBIO MARCI. (Larva.)

The generality of species belonging to this curious genus feed upon decaying substances, but the larva of St. Mark's-fly frequently changes its residence, and does great harm in the garden. Large groups of these grubs may be found assembled in a very small space, upwards of a hundred having been discovered in close proximity to each other. These creatures feed largely upon the roots of the strawberry and valuable garden flowers, not unfrequently destroying the life of the plant. The ranunculus is often attacked by this voracious larva, which has been known to lay waste whole beds of the flowers for several successive seasons.

This grub is not very large, and of a brown colour, and its segments are furnished with rows of short and stiff hairs, which act as feet and enable the larva to progress. Its shape is almost cylindrical, becoming flatter along the belly. There are few insects in which the characteristic difference of the head in the two sexes is so boldly shown as in the St. Mark's-fly. The head of the female is longer than wide, and the eyes are small and set far apart. The head of the male, on the contrary, is wider than long, and very spherical, its bulk seeming to be wholly made of the enormous protuberant eyes, which are only separated from each other by a very narrow line on the back of the head.

PEAR-MIDGE.

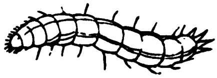
Closely allied to St. Mark's-fly is the Pear-Midge (*Sciara pyri*) a pretty little fly with blackish wings, and slate-coloured abdomen. The larva burrows into the pear, and on account of the nauseous black dust with which the burrow is partially filled, the fruit is rendered quite uneatable.


THE GREAT CRANE-FLY.

The next insect which will be described is one of a most destructive genus. The Daddy Long Legs, or Crane-fly (*Tipula gigantea*), is very plentiful in our gardens, and may be observed towards dusk flitting over the grass with its short, feeble flight, and apparently being a very harmless creature.

If several of these insects be caught and examined, some will be found to have a sharp-pointed apparatus at the end of the abdomen, while others are destitute of that appendage. The latter are the males and the former the females, the appendage being the ovipositor. By a little careful watching, some of these Crane-flies will be seen to sit upright as it were, and to a casual observer would appear merely to be clinging to the grass blades. If, however, they be closely examined, they will be seen to push the sharp ovipositor into the ground with a movement not unlike that which a carpenter uses in boring a hole with his bradawl. By means of this operation, a slight hole is made in the ground, and therein the fly lays its eggs.

When these eggs are hatched, the larvæ become nearly as destructive to the grass as those of the cockchaffer, always remaining hidden underground, and feeding upon the roots of the grasses. Their ravages are sometimes extraordinary, and but for the exertions of the rooks and starlings they would utterly destroy many a fine grass-field.



CRANE-FLY. (Larva.)

On my own lawn, the starlings are engaged from early dawn until after sunset picking out these and other grubs, and it is wonderful to see how quick and certain they are in their movement. They go running over the grass, with eyes and ears watching for prey; they swallow wireworms and small insects in vast numbers; and every now and then they stop, peer into the ground, peck sharply once or twice, and then dig smartly into the earth, pulling out with a triumphant flourish some large grub, usually that of a Crane-fly or a cockchaffer. The lawn is covered with holes made by their long, sharp beaks, each hole showing that a destructive grub has been detected and devoured.

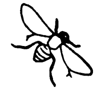
Not only do the larva of the various Crane-flies attack the grass, but they feed upon the roots of scarlet beans, dahlias, potatoes, lettuces, and other valuable plants, so that we ought to feel peculiarly grateful to any creature that will destroy such pests. No less than thirty-six species of Crane-fly inhabit England, all of which are easily recognised by their form and dimensions.

THE last of the Diptera for which we can find room a insects which are placed in the genus Tephritis. The i belonging to this genus are very destructive to our garden larvæ making their way between the two coats of the leave causing the epidermis to swell into large blisters. In species the larva forms a kind of gall round its body.

The commonest, and perhaps the most mischievous, of insects is the CELERY-FLY (*Tephritis onopordium*), the lar which burrows in the plant from which it derives its Hundreds of the blisters may be upon the leaves, and in each of th single grub is just visible. The nun of these creatures are sometimes very g so that they inflict serious damage the celery crop, and it will always be ful to set children to kill the grubs. tunately, they are very tender, thin-skinned little things, can be destroyed by squeezing them between the fingers. C plants, such as the parsnep, suffer from the same insect.

CELERY-FLY.

The fly itself is a very pretty little creature, and as it is fo sunning itself, and resting almost motionless upon leaves, ma easily captured. Generally, the wings of dipterous insect simply membranous, but those of the Celery-fly are beauti mottled with black and very pale brown. The colour of body is rather variable, but is always brown or black; the l are yellow, and the eyes green. This last-mentioned colour after death. The fly is found in the perfect state throughou summer from May to July. The grubs quit the leaves they are full grown, and burrow into the earth, where they re for a variable period, those of the first brood passing but a paratively short time in the pupal dition.



TEPHRITIS CENTAUREA.

Another species of this destructive g is the insect which is shown in the ac panying illustration, the larvæ of w feeds in a similar manner.

CHAPTER XXVI.

SPIDERS—Character of the Class—The WOLF and HUNTING SPIDERS—Their Habits—Method of catching their Prey—Their Eggs and Love for their Young—The GARDEN SPIDER—Its Web—Its Value as a Barometer—The Services which it renders to the Gardener—Method of taming it—Various MITES—Their Habits and Destructive Qualities—The RED SPIDER—Its Ravages in the Greenhouse, and best Method of Destroying—The CENTIPEDES or MYRIAPODA—Why so called—Various Centipedes The LUMINOUS CENTIPEDE—Its curious Properties—An Unpleasant Habit—MILLIPEDES—The JULUS and its Habits—The PILL MILLIPEDE and its Resemblance to the Armadillo Woodlouse—Simple Method of Distinguishing them—The EARTHWORM—Summary of its Habits—Its Friendship proved—Its Services—Exceptional Cases when it must be killed, and the best Method of doing so—A remarkable Instinct—Concluding Observations.

THE greater part of the SPIDERS are decidedly friends to the gardener, and indeed, all those creatures which are properly classed under that title may be reckoned among his allies. Although many persons consider the Spiders to be insects, they have no claim to that designation, because they possess no separate head, and their breathing organs are arranged on a different principle. There are many other distinctive characteristics, but these are the most obvious and important.

There is scarcely any necessity for me to mention that the services rendered by Spiders consist in the vast number of insects which they destroy—some by catching their prey in fair chase, others by snaring them in webs, and others by a kind of mixture of these two plans.

The common Wolf-Spider (*Lycosa saccata*), so common on our lawns, is an example of the hunter spiders. This creature is represented in the accompanying illustration, and is very slightly magnified. The specific name of *saccata* is given to this spider on account of the little sac or ball of eggs which the female always carries about after she has made them up into a spherical packet. She is greatly attached to her eggs, and if they be taken away from her becomes quite miserable, hunting over every inch of ground, and showing her regret and anxiety by her quick restless movements. She is as deeply attached to them as a bird is to her eggs, but with a wholly instinctive attachment, devoid of reason; for, like the bird, the spider is satisfied with anything that bears the semblance of her lost treasure, and will be as pleased with a little ball of cotton wool as with the veritable egg packet.

WOLF-SPIDER.

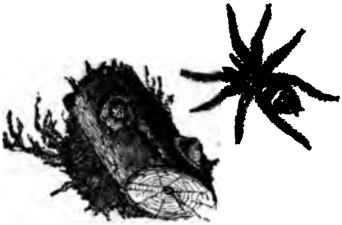
Our next example of these creatures is called *par excellence* the Hunting Spider (*Salticus scenicus*), on account of its wonderful agility in pursuit of prey.

It is a pretty creature, brown, banded obliquely with white. This spider is a deadly foe to flies, chasing and pouncing upon them with a spring like the leopard's leap. It cares not where the fly may be, whether on a level surface or on a perpendicular wall, but will leap at it, always with the same success, and always without fear of falling. In order to guard against the possibility of falling to the ground, it draws a silken cable behind it wherever it goes, and so, when it leaps upon a fly that is

HUNTING SPIDER.

traversing the wall, the spider and its prey hang for a moment by the silken cable, until the spider swings within reach of the wall, which it seizes and rapidly regains.

I strongly recommend my readers to amuse themselves by watching the proceedings of the Hunting Spiders. These little beings are very common, and may be seen on any sunny surface. They run about with surprising energy, and in a quick jerking manner, moving to either side, backwards or forwards, with equal ease. They are very bold, and will allow themselves to be watched quite closely without betraying any alarm.



DRASSUS MICANS (and eggs).

In the accompanying illustration may be seen a figure of another common British Spider (*Drassus micans*), for which, however, there is no popular name.

All the members of this genus hunt after their prey, catching it by fair chase. They hide themselves in silken cells spun among leaves, or under stones, or in any convenient chink, and dart out suddenly on their victims. One species has been observed to descend below the surface of the water for this purpose. This species has been selected, in order to show the curious method in which the eggs are laid, being placed upon twigs or branches, and covered with a kind of pyramidal tent of silk. These egg-masses should always be respected.

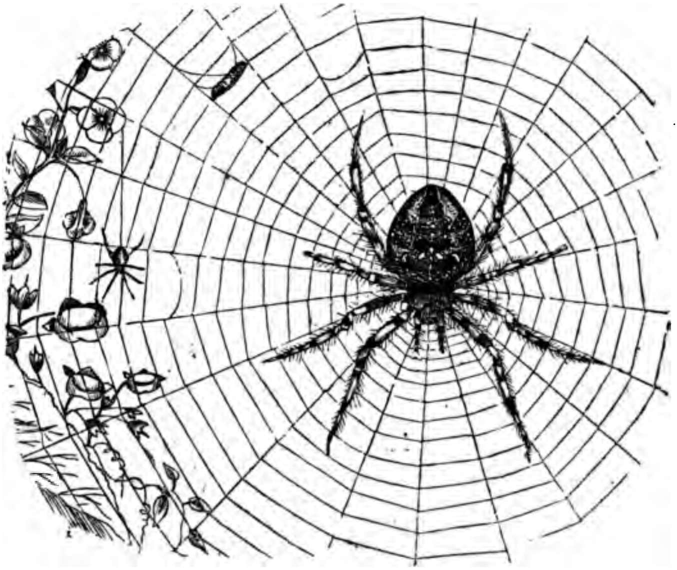
The colours of the adult spider are very beautiful, the front of the body being rich chocolate, streaked with white, and the abdomen of the deepest green, with reflections of copper and purple in certain lights. It is a very small species, and in order to exhibit its shape more accurately, the figure is slightly magnified.

It is of course impossible, in a work of this character, to enumerate all the British spiders, and we will, therefore, content ourselves with briefly noticing one or two of the commoner examples. There is a somewhat extensive genus belonging to this large family, called *Clubiona;* and one of the prettiest species of this genus is the *Clubiona holosericea.* This spider, in common with others of the same genus, can run easily on perfectly smooth perpendicular surfaces, by means of an adhesive secretion which is poured from its feet. It is rather a wandering creature, traversing a considerable space of ground. It has, however, a definite home, and when at rest resides in a cell composed of white silken threads, which is placed under leaves, or behind the rough bark of old trees. But when the female has deposited her eggs, an event which takes place in June, she forgets her nomad customs, and never leaves the spot where she has placed the elements of her future brood.

The reader is probably aware that many spiders are very affectionate parents, the young clambering upon the body of their mother, and sometimes covering her so completely with their masses, that her outline is entirely undistinguishable. The cocoon of the Clubiona is about a quarter of an inch in diameter, disk-shaped, and contains rather more than one hundred yellowish white eggs.

THE common GARDEN SPIDER (*Epeira diadema*) is too well known to need description. It often attains a large size, many specimens having reached the dimensions exhibited in the illustration. The female, however, is very much larger than her mate; but after she has laid her eggs, the size of her body is notably reduced, and she does not appear to be nearly so formidable a being.

The web of this spider is most beautifully made, and it may be useful to the gardener to remark, that the Garden Spider is an admirable barometer, and that its webs, as well as the mercury, afford indications of the weather. Whenever the spider begins to repair its net, fine weather is near at hand, no matter how stormy the sky may appear. These spiders can be in a manner tamed, and will soon learn to come and take flies out of the hand. It is not at all necessary that the flies should be held against the web, so as to give the spider warning, for the little creatures possess the two qualities of memory and association, and very soon learn to look out for a fly whenever a hand is brought near their silken home.



GARDEN SPIDER.

The Garden Spider will often spin its web quite close to the ground, and such nets are always crammed with relics of the destructive Crane-flies, which seldom rise to any great height, and which therefore fall victims to the destroyer. It is surprising how many of these flies a single spider will manage to receive, rolling them up in a silken shroud, so as effectually to prevent them from escaping. An insect thus rolled up may be seen on the upper part of the illustration. The name of Cross Spider is also given to this species, because there is a triple cross upon its back, something like the mysterious emblem borne by the Grand Master of the Knights Templars. The colour of the cross is mostly yellow upon a brown ground.

THE MITES also belong to the Spider tribe. Some of these beings are extremely injurious to vegetation.

Perhaps the worst of these little pests is that which is known among gardeners by the name of RED SPIDER (*Acarus tellarius*). It is a very tiny being, scarcely visible to the naked eye except as a reddish speck traversing the leaves. Greenhouses are especially liable to harbour this little Mite, which works sad destruction among the most valuable plants, causing their leaves to shrivel, and giving them an appearance which is not easily described, but which cannot be mistaken when once seen.

When it has taken possession of a greenhouse, it can mostly be extirpated by fumigation with sulphur; but great care must be taken lest the sulphur should take fire, as in that case the fumes would destroy not only the Mites, but the plants. A temperature just below that of boiling water is amply sufficient for the purpose, and can be obtained by placing flowers of sulphur on common hot-water plates, or by filling large stone jars with boiling water, and scattering the sulphur upon them. The walls should be well washed with soft soap, sulphur, and very fine clay. Sulphur may also be mixed with the whitewash applied to the greenhouse or hothouse, that substance being fatal to the smaller spiders, as is well known to medical men, who apply it in ointment for the purpose of killing the little mite that burrows into the human skin and produces the itch. Spirits of turpentine are also effectual, but much more costly.

Another species, *Acarus holosericeus*, is very like the preceding, but may be distinguished by its colour, which is bright scarlet instead of dull red or yellow.

The GARDEN MITE (*Acarus hortensis*) preys upon the cucumber, and probably upon other plants. It is at all events found upon such plants, and may be known by its colour, the fore part of the body being yellowish, and the abdomen whitish grey.

The Plum Mite (*Acarus geniculatus*) is found in the open air, attacking the plum and other trees, and often doing considerable damage. It is mostly seen upon the small twigs, near their junction with the branch, and in some seasons is so plentiful that the congregated masses look more like exudations from the tree than assemblages of living beings. The best remedy is to wash the affected spots with a brush dipped in tobacco-water, spirits of turpentine, or the Gishurst compound.

Our last example of these beings is the Scarlet Mite (*Trombidium hirsutissimum*), so plentiful upon banks. The beautiful soft woolly coat of this creature is well worthy of examination under the microscope. The well-known Harvest-bug is closely allied to the Scarlet Mite.

Another class of beings now comes before our notice, of which we can only mention a very few species. These are the Centipedes, scientifically called Myriapoda, both names having similar significations, and alluding to the number of the legs.

Some of the Centipedes are very annoying creatures, crawling into any little crevice, and hiding themselves under wall-fruit, in flower-pots, in the fingers of garden gloves, and similar localities. The species which has been called after Mr. Leach is about an inch in length, and is of a deep iron-brown colour, with hairy antennæ and yellow legs.

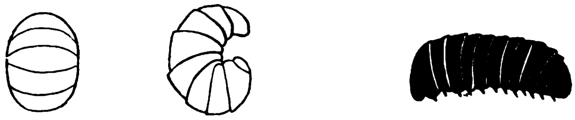
There is one slender and almost elegant species, called the Electrical Centipede (*Arthronomalus longicornis*), of a rather light yellow colour, with a reddish brown head. This little creature is remarkable for its luminous qualities, a bluish light being given out at night as it moves along, and causing it to be often mistaken for the glowworm. This little Centipede is extremely fond of ripe stone-fruit, and has a habit of boring its way into the peach, plum, apricot, or greengage, and coiling itself closely round the stone, in the very midst of the sweet juices which always are found in the centre of the fruit. The

Centipede always enters just by the stalk, so that the aperture is not perceptible; and it often happens that persons who have *too* hastily eaten a plum or an apricot, find that they have *bitten* a Centipede as well as the fruit.

The common Millipede (*Julus terrestris*) is closely allied to the centipedes. This creature mostly feeds upon decaying vegetable substances, and may be found in profusion under old logs that have lain for some time on the ground. It sometimes, however, alters its food, and eats dead earthworms and other substances of an animal nature. Those specimens which live in such localities are generally of redder and lighter tints than those which are in the habit of visiting the open air. It not unfrequently happens that when a large log, or dead tree-stump is turned over, a great number of Millipedes are found, some of which have contrived to entangle themselves in the webs of the wolf-spider, and continually coil and straighten their bodies without producing the slightest change in their condition.

ULUS MILLIPEDE.

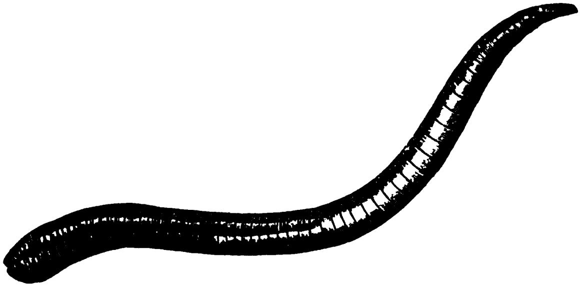
The Pill Millipede (*Glomeris marginata*) resembles the armadillo woodlouse so closely that it is often mistaken for that being. There is, however, very little difficulty in distinguishing the two creatures. One very conspicuous mark of difference lies in the legs, which in the armadillo woodlouse are set far apart, but in the Pill Millipede are placed in a single line along the centre of the body, so that when the creature is walking their extremities do not project beyond the sides.



PILL MILLIPEDE.

Our last example of the garden friends and foes belongs to the large class of Annelids. This is the well-known Earthworm (*Lumbricus terrestris*) a creature which undoubtedly deserves to be placed in the former class.

Gardeners are in the habit of ranking the worm among their enemies, and of destroying it by every means in their power. I do not deny that in some cases the creature is a nuisance, and must either be exterminated or its numbers thinned. Sometimes the worms are too numerous in a garden, or upon a lawn, or they get into the flower-pots.



EARTHWORM.

In the last-mentioned case they are undoubtedly nuisances. They have no business in flower-pots, and in such localities they are so destructive that they often force the gardener to move the plant into another pot for the sake of discovering and killing the worms. Sometimes a lawn will be so full of worms that their casts will quite disfigure its smooth surface, and in this case their numbers must be thinned. But as a general fact, the Earthworm is a most useful ally. It makes innumerable drains, permitting the air to penetrate into the earth, and forming passages through which the superabundant moisture can be conveyed into the greater depths where it is needed, and it continually flings fresh and beautifully fine soil upon the surface, forming, in fact, an invaluable "top-dressing" such as money cannot purchase.

The Earthworm is a vegetable feeder, eating roots and decaying vegetable substances. The reader may probably have noticed that leaves are continually dragged into the holes of the Earthworm, their points being directed downwards, so that they are twisted into a form very like the paper "cornets," in which grocers envelop their goods. These leaves are drawn into the burrows by the Earthworm, as I have often witnessed, and they serve a double purpose. The worm is able to feed upon their buried tips, and the great cocktail beetle is prevented from entering the burrow in search of the worm on which it preys.

Should any of my readers find that the Earthworm has taken possession of their lawn, flower-pots, or garden-frames, they can easily remove it by employing the solution of ammonia which has so often been recommended. Its effects are positively marvellous, and the number of worms and grubs that will be found even in a small patch of grass, will surprise one who employs this solution for the first time.

With the Earthworm ends our list. I have only to say in conclusion, that if any strange insect or other being should be found in our garden, and we do not see it actually engaged in the work of destruction, or do not know it to be one of the garden foes, the safest, as well as the most humane plan will be, to rank it for the present as a neutral, and in all cases rather to run the risk of allowing an enemy to escape, than of destroying as a foe a creature that is really one of our friends.

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THE END.

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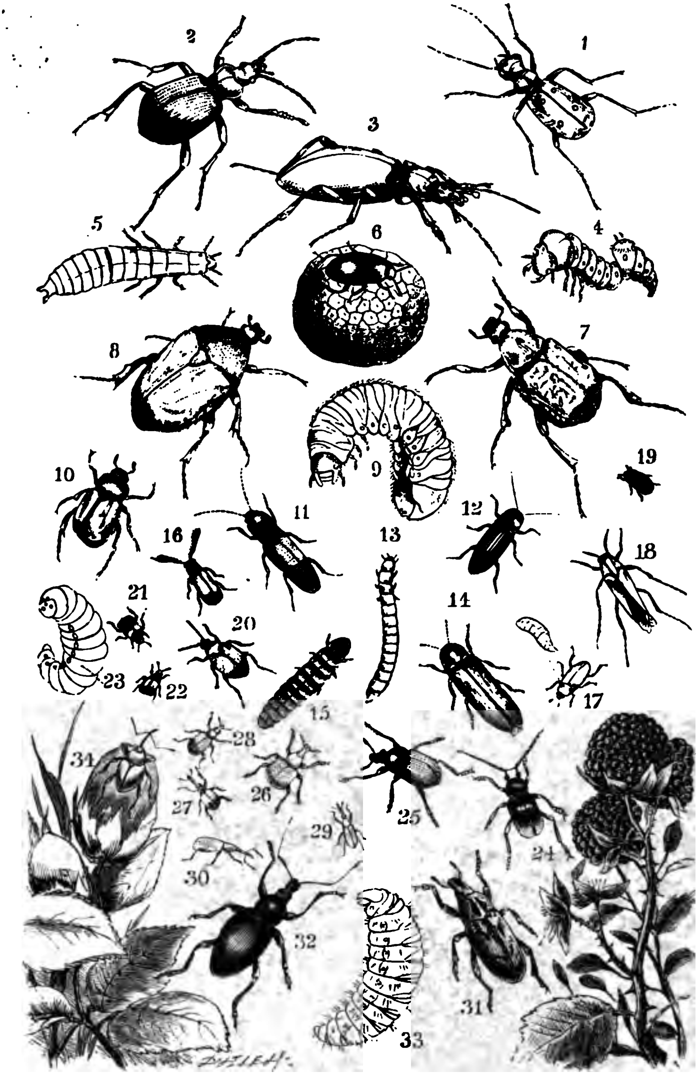
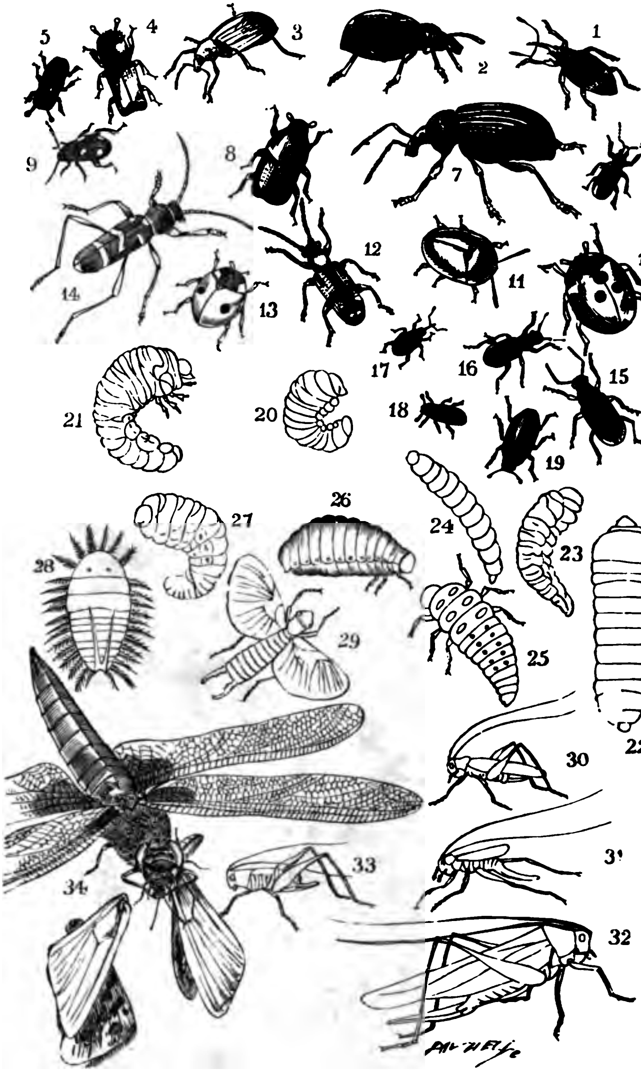
PLATE I.



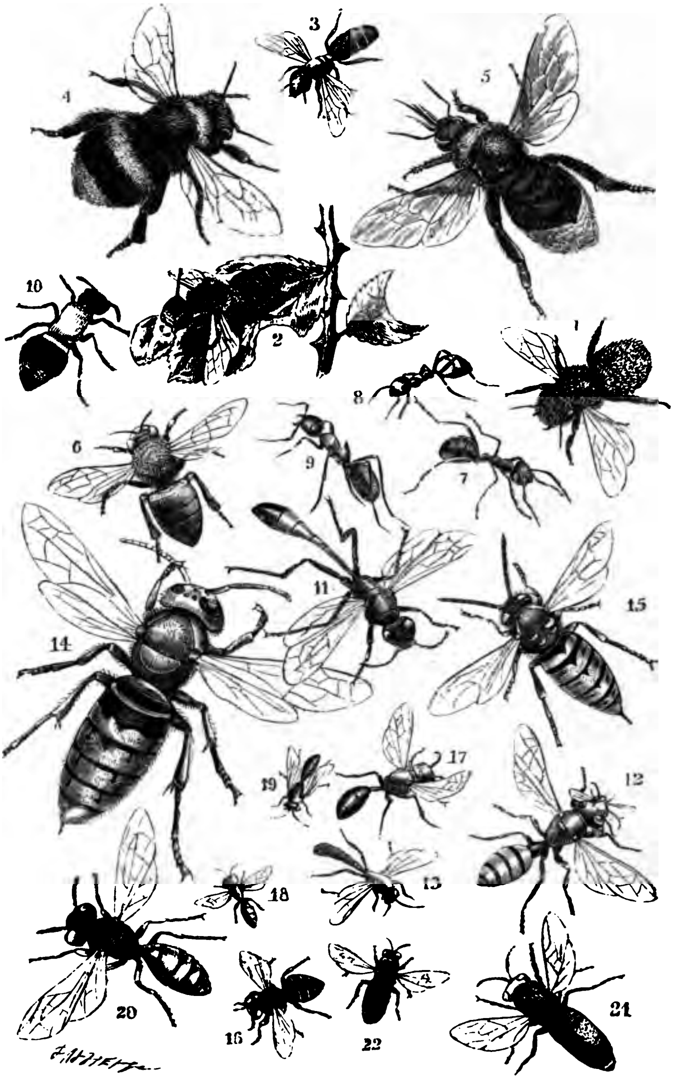
1. Cicindela campestris (Tiger beetle) 2. Calosoma inquisitor. 3 Carabus violaceus
4. Larva of Cincindela campestris. 5. Larva of Calosoma sycophanta.
6. Anisotoma cinnamomea (Trouffle beetle.) 7. Gnorimus nobilis. 8. Cetonia aurata (Rose chaffer.
9. Larva of Cetonia aurata. 10. Phyllopertha horticola. 11. Athous hæmorrhoidalis.
12. Agriotes linearis. 13. Larva of Agriotes linearis. 14. Lampyris noctilucus (Male glow-worm.)
15. Female of Lampyris noctilucus (Glow-worm.) 16. Drilus flavescens.
17. Byturus tomentosus and larva (Raspberry beetle.) 18. Rhipiphorus paradoxus.
19. Cis boleti 20. Bruchus pisi (Pea weevil.) 21. Bruchus seminarius. 22. Bruchus villosus.
23. Larva of Bruchus pisi. 24. Anthribus albinus. 25. Attellabus curculionides. 26. Rhynchites cupreus.
27. Rhynchites alliariæ. 28. Rhynchites betuleti. 29. Apion trifolii. 30. Apion radiolum.
31. Cleonus sulcirostris. 32. Otiorhynchus tenebricosus.
33. *Larva of Otiorhynchus tenebricosus.* 34. Balaninus nucum (Nut weevil.)

PLATE II.



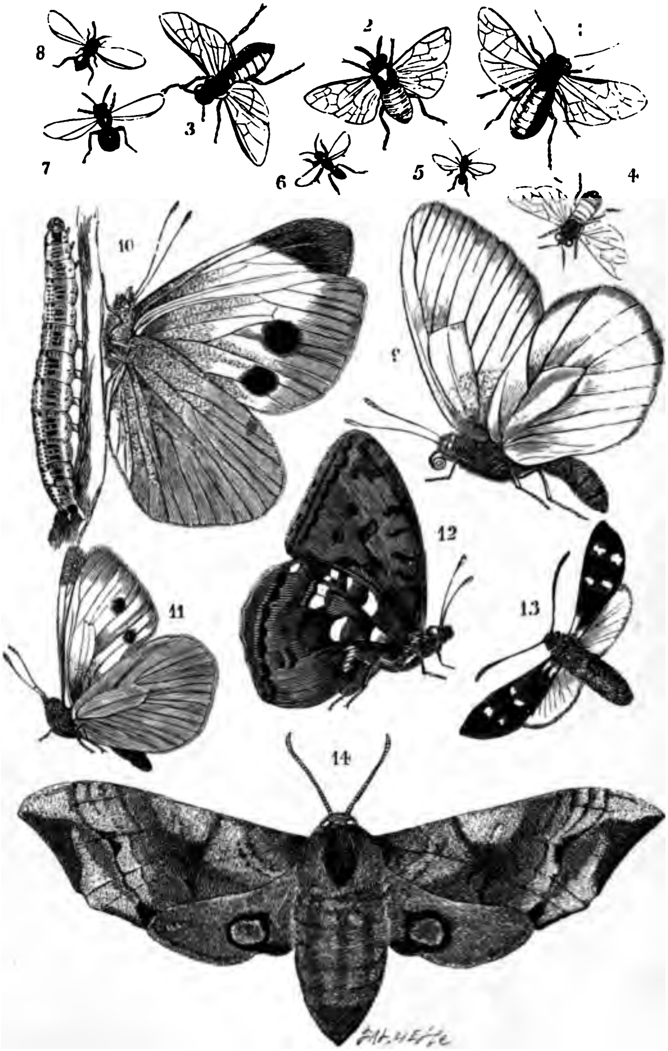
1. Anthonomus pomorum (Apple weevil.) 2. Otiorhynchus picipes. 3. Phyllobius pyri.
4. Tomicus bispinus. 5. Tomicus dispar. 6. Phyllobius oblongus. 7. Otiorhynchus sulcatus.
8. Scolytus destructor. 9. Phyllotreta brassicæ. 10. Coccinella labilis. 11. Cassida viridis.
12. Crioceris asparagi. 13. Coccinella bipunctata (Common ladybird.) 14. Clytus arietis.
15. Sitona lineatus. 16. Sitona sulcifrons. 17. Ceuthorhynchus didymus. 18. Hylesinus crenatus.
19. Hylesinus fraxini. 20. Larva of Scolytus destructor. 21. Larva of Phyllobius pyri.
22. Larva of Cerambyx. 23. Larva of Anthonomus pomorum. 24. Larva of Phyllotreta.
25. Larva of Coccinella bipunctata. 26. Larva of Crioceris asparagi. 27. Larva of Otiorhynchus picipes.
28. Larva of Cassida viridis. 29. Forficula auricula. 30. Decticus griseus.
31. Mecronema varium. 32. Locusta viridis. 33. Decticus verrucivorus. 34. Libellula depressa.

PLATE III.



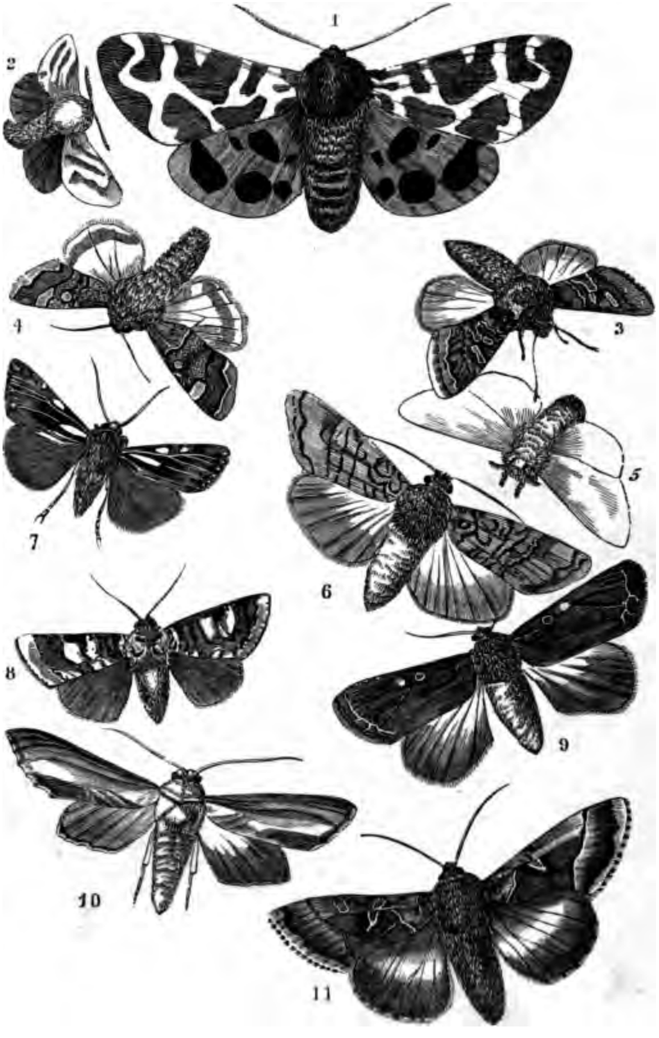
1. Osmia bicornis (Mason bee.) 2. Megachile Willoughbiella (Leaf-cutting bee.)
Chelostoma florisomnis. 4. Bombus terrestris (Common humble bee.) 5. Apathus vestalis (Cuckoo bee.)
6. Apis mellifica (Honey bee.) 7. Formica niger. 8. Formica flava. 9. Formica fusca.
10. Mutilla Europaea. 11. Ammophila sabulosa. 12. Mellinus arvensis. 13. Trypoxylon figulus.
14. Vespa crabro (Common hornet.) 15. Vespa vulgaris (Common wasp.) 16. Oxybelus ferox.
17. Pemphredon lugubris. 18. Stigmus troglodytus. 19. Psen atratus.
20. Philanthus triangulum. 21. Chrysis ignita. 22. Chrysis cyanea.

PLATE IV.



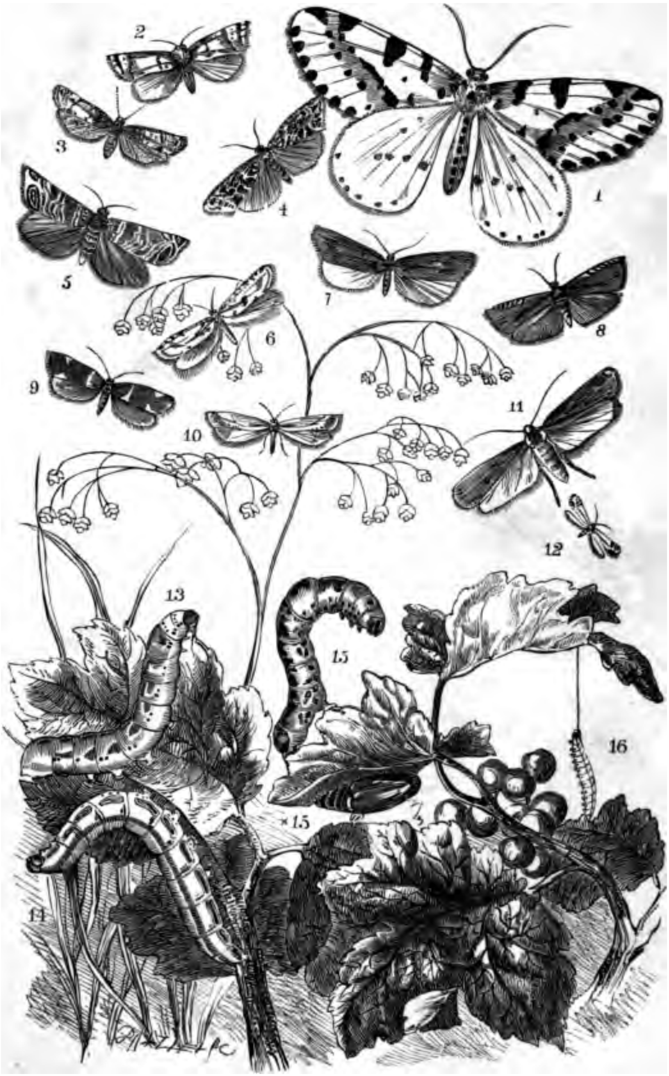
Nematus grossulariæ. 2. Athalia spinarum. 3. Hylotoma rosæ. 4. Selandria æthiops.
5. Microgaster glomeratus. 6. Microgaster alvearius. 7 Cynips Kollarii.
8. Cynips quercifolii. 9. Aporia cratægi. 10. Pieris brassicæ. 11. Pieris rapæ.
12. Argynnis Adippe. 13. Anthrocera filipendulæ. 14. Smerinthus ocellatus.

PLATE VI.



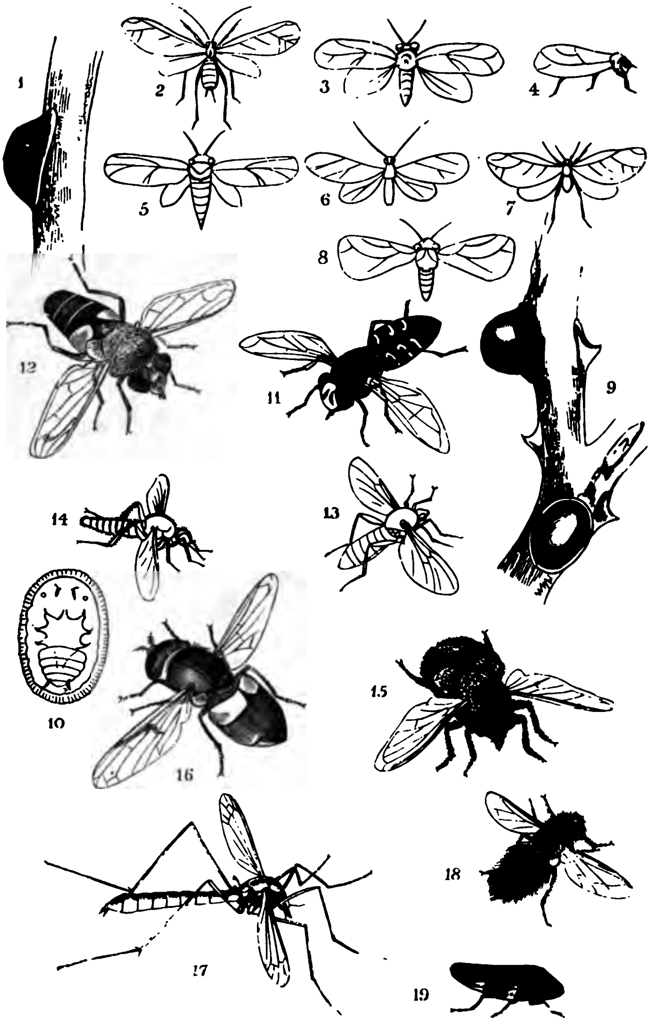
1. Arctia caja. 2. Clisiocampa castrensis. 3. Dianthesia capsincola. 4. Mamestra pisi.
5. Euproctis chrysorrhæa. 6. Mamestra brassicæ. 7. Cerapteryx graminis.
8. Dianthesia compta. 9. Mamestra oleracea. 10. Cucullia verbasci. 11. Plusia gamma.

PLATE VII.



1. Abraxas grossulariata. 2. Crœsia Bergmaniana. 3. Spilonota ocellana. 4. Semasia Weiberana.
5. Carpocapsa pomonella. 6. Tinea corticella. 7. Euchromia fulvipunctata.
8. Endosisa nigricana. 9. Incurvaria capitella. 10. Plutella porectella. 11. Hyponomeuta padellus.
12. Depressaria nervosa. 13. Larva of Mamestra oleracea. 14. Larva of Mamestra pisi.
15. Larva and pupa of Abraxas grossulariata. 16. Larva of Spilonota ocellana.

PLATE VIII.



1. Lecanium vitis. 2. Aphis rosæ. 3. Anissoropha ficus. 4. Pyslla pyri. 5. Pyslla mali.
6. Schizoneura lanigera. 7. Aphis rumicis. 8. Pyslla cratægi. 9. Aspidictus rosæ.
10. Coccus adonidum. 11. Syrphus pyrastri. 12. Eristalis tenax. 13. Empis tessellata.
14. Bibio marci. 15. Volucella plumata. 16. Volucella pellucens. 17. Tipula oleracea.
18. Tachina vulpina. 19. Aphrophorus spumario.

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